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PART I., NEW SERIES.

JOURNAL

OF THE

Agricultural and Horticultural Society

OF

INDIA.

Report on the supposed poisonous properties of Jowar, (Sorghum Vulgare). Communicated by Veterinary Surgeon J. ANDERSON, to Commissioner of the Silupur Division, Oude.

I HAVE the honor to acknowledge the receipt of your dockets, No. 2880 and 2931, dated 12th and 17th Instant respectively, forwarding copies of Deputy Commissioners of Hardoi and Kheris, Nos. 1635 and 1790 and their annexures on deaths among cattle by eating jowar, and in reply beg to state that, from my recent investigations and experiments, I have come to the conclusion that jowar is not poisonous. Some stalks here and there contain insects, others a fungus, both of which are supposed by many to be the medium of poison. Even if they were poisonous they are not found in sufficient quantities to prove injurious, and account for such wholesale mortality.

The prevailing idea is that the jowar has become poisonous not only from want of the usual rains, but also from the scorching effects of the unusual return of the hot winds, action of the atmosphere; or that a poisonous gas has been engendered in the stalk by the action of the heat, weather, &c. &c. &c.

The insects are of the Hemiptera or bug order, commonly met with on plants, and the fungus, when submitted to a microscopical examination, consisted almost entirely of round spores. Dr. Franklin who examined it cannot say to what species it belongs.

VOL. VI., PART I., NEW SERIES.

2 *Report on the supposed poisonous properties of Jowar.*

A sample has been sent to an expert fungologist in Calcutta for examination and report. A parcel of jowar which was collected in the Mulliabad thannah, Lucknow district, from the khets where animals have eaten and died, has been sent to the Chemical Examiner for analysis.

I look upon jowar as a destructive substance or thing and not as a poison. It destroys life by acting mechanically on the system, just as a sponge swells in the stomach and kills on being retained there. When jowar has been eaten it generally produces "hoven," distension of the first stomach as known by the generation of a large quantity of confined air, a product of fermentation arresting the natural function of rumination and digestion which causes the animal to swell even to a state of suffocation, or rupture of some part of the stomach or intestines and death.

This is all in obedience to a pathological law that over-distension of a hollow viscera paralyzes it and secondary symptoms supervene, such as follow impaction or distension of the stomach under other circumstances, *viz.*, those of sympathetic derangement of the nervous system indicated by convulsions, delirium, and death.

Hoven therefore is a very common and exceedingly fatal form of disease, or rather accident. The stomach becomes surcharged with flatus, becomes paralysed as it were, and is thus rendered incapable of expelling its contents. Consequently, rumination and digestion cannot be carried on properly, but fermentation goes on instead by which a large quantity of gas is immediately generated which, from want of ventilation, causes the animal to swell to a state of suffocation, and sudden death is the consequence.

The symptoms are very alarming and rapid in their course, they may come on sometimes, if only a *very small quantity* of jowar has been eaten. The left flank swells up, accompanied by distressed and labored breathing; panting and great depression, disinclination to move, with prominent and blood-

shot eyes; dilated pupils; saliva flows from the mouth, trembling of the hind legs; blindness and insensibility with great derangement of the nervous system; the animal staggers about, falls down, and dies delirious of suffocation.

Hoven is the result of irregular and bad feeding, or from cattle eating food which they are unaccustomed to; or from eating *partially decayed* or unripe fodder of any description (stunted jowar) and particularly succulent shoots which spring up after the first showers of rain. Cattle are sure to overgorge themselves, more especially half-starved ones, or eat so greedily that it is not sufficiently masticated, and before it can be properly prepared by rumination, fermentation takes place, and carbonic acid gas is eliminated. Hoven is the result, appearing like an epizootic affecting many animals at the same time and place.

As this complaint is preventable, the Assamis should hinder their cattle from eating jowar by herding them, or by fencing in the jowar khets. This has been done in many places with marked success.

Hoven runs its course with such rapidity, requires that the treatment must necessarily be very active. This, in India at present, is almost impossible with such an apathetic, prejudiced, and superstitious people like the ordinary cattle-owner who, as a rule, thwart, instead of assisting the salootries in carrying out the most simple treatment.

The first thing to be done is to arrest the process of fermentation and restore healthy secretion and action of the stomach. To do this the air must be displaced by eructation or through the intestines, or by opening the stomach with a trocar and cannula the latter should be left in the wound for some time so that the gases generated may escape as fast as formed.

In the absence of the proper instrument, a common sharp pointed knife may be used, which should be plunged at once into the rumen at the upper portion of the left flank

4 *Report on the supposed poisonous properties of Jowar.*

between the last rib and the point of the hip-bone, and at equal distance from the last rib and point of the hip-bone and the side bones of the loins, making the opening large enough to admit the finger into which a small bamboo or other tube should be inserted. To prevent its slipping into the stomach a piece of stick, three or four inches long, should be tied across that portion of the tube outside the wound.

Exercise and dashing cold water acts as a nerve stimulant producing contraction of the walls of the rumen and eructation. In many places the Assamis adopt the cold water cure and believe in it thoroughly. The following should be given at once in half seer of warm water or ghee :

Arrack	...	...	$\frac{1}{2}$ pint.
Powdered ginger	...	...	2 ozs.
Powdered black pepper	...	...	$\frac{1}{2}$ ounce.

Half the dose for young and half grown animals (Hallen). Any of the following may be given if at hand :—

Essence of ginger, tincture of cardamums, solution of chloride of lime, asafetida, soda, whisky, oil of turpentine, linseed oil, lime water, in their proper doses well diluted with warm water, or ammonia in cold water.

After the symptoms have abated, a dose of purgative medicine should be given. The following is easily procured :—

Linseed oil	...	1 pint.
Sulphur	...	4 ounces.
Ginger	...	$\frac{1}{2}$ ounce.
Warm water or gruel	...	$\frac{1}{2}$ seer.

(Hallen.)

For a few days the animal should be fed on sloppy and easily digested diet. 6

I have given an experimental bullock as much as six seers at one time, of what was supposed to be poisonous jowar, and it had no effect whatever. I attribute this simply to the fact that the animal ate it leisurely, masticated it properly, and ruminated quietly. The same animal has had it dried

in the form of bhoosa and in decoction. The experimental sheep will not eat more than a stalk at a time, and after being starved for 24 hours. A strong decoction had no effect on them either.

Sheep, in a state of nature in the district, evidently do eat jowar and suffer from it too. In the Roy Bareilly District 48, and in Gonda 31, were returned as having died from eating jowar, and Mr. Oliphant, in a letter to the *Pioneer* of 13th instant says: "I have frequently made *post mortem* examination of sheep that have died from eating the young green shoots of the cut jowar, in the early part of the cold season, and have also successfully treated the affected animals when I have been fortunate enough to get hold of them in time."

The Deputy Commissioner of Lucknow says, "when on tour he was told that deer eating the jowar died." From returns received many goats have succumbed; also horses and donkeys.

The mortality in the Sitapur Division alone will not be far short of 2,000 head, when the returns are complete. This great loss through neglect and ignorance ought to rouse cattle-owners from their apathy, and show them the necessity of storing fodder in plentiful seasons, preserving pastures, and fencing in crops.

LUCKNOW, 24th September, 1877.

*Memorandum by MR. J. S. GAMBLE, dated the 27th July 1878,
on the different species of Prosopis.*

(Communicated by the Inspector General of Forests.)

Prosopis, a genus of Leguminous trees of the sub-order *Mimosæ*, contains about 18 species dispersed over the tropical and sub-tropical regions of Asia, Africa and America. Of the five sections which compose the genus—sections whose characters are based to some extent upon the shape and

structure of the fruit, three may be noticed :—

1. With the pod smooth or slightly thickened at the seeds	} Adenopis	...	{ Contains the two In- dian species <i>P. spicigera</i> , the well-known 'Jhand', and <i>P. stephaniana</i> of the Northern Punjab plains and Western Asia.
2. With the pod smooth, thickened at the seeds so as to be almost jointed, and generally falcate ...	} Algarobia	...	{ Contains two of the species now being grown, <i>viz.</i> , <i>P. glandulosa</i> of the mountains of Western Texas, and <i>P. pallida</i> of South America.
3. With the pod spiral- ly twisted	} Strombocarpa	...	{ Contains the true Mes- quit bean or <i>P. pubes-</i> <i>cens</i> of Texas and New Mexico.

The 'Jhand' *P. spicigera*, Linn., is too well known to require further notice than is given in the Forest Flora of North-West and Central India.

P. pallida, Kunth; is a native of South America, and has been successfully grown in Ceylon. Its pods are considered of high value as a tanning material, containing, it is said, as much as 90 per cent. of tannic acid. They are known by the name of 'Balsamocarpon.'

P. glandulosa, Torr.; the 'Mesquit or Algaroba of Texas', is a native of the mountain regions of Western Texas, where it grows into a small tree from 20 to 40 feet high, and with a diameter of 18 inches. It has straight or curved, rather flattened, almost jointed pods, the interior of which is filled with a sweet pulp. The pods, it is believed, are useful for fodder, and are not injurious. It yields an excessively hard and durable timber, with a beautiful grain, and is used for furniture, picket poles, and in the manufacture of charcoal. It also affords a large quantity of gum resembling gum arabic, which exudes from the stem and branches, and has been used as mucilage, in the making of jujubes, and for other purposes. *P. pubescens*, Bth.; the 'Screw Bean' or 'Screw Mesquit,' is a small tree of Texas, New Mexico and Arizona. It is the 'Tornillo' of the Sonora Mexicans, and is remarkable for its screw-shaped pods. These pods grow in abundant clusters of

8 or 10 upon the same stem, ripen at all times of the year and contain much nutritious saccharine matter. The pods have been said to be valuable as fodder for horses; but a recent communication addressed to the Assistant Director of the Royal Gardens at Kew, by Mr. R. Thomson of the Cinchona Plantation, Jamaica, and detailing an experiment he had made which resulted in the death of a horse, shews that great caution is required in their use as fodder for horses. It is suggested, however, that these injurious effects are not noticeable when the beans are given to cattle.

Another species, a native of Jamaica, whose fruits have poisonous properties is the *P. juliflora*, DC., of the section 'Strombocarpa', though, for other purposes, the tree appears to be useful for planting in some localities, as the plants when once established go on sending up shoot after shoot, and are difficult to eradicate.

The following extract of a communication to the *Gardeners' Chronicle* of the 31st August 1878, by Mr. John R. Jackson of the Kew Gardens, in respect to the poisonous properties of the Cashaw tree (*Prosopis juliflora*) will be read with interest:—

"With reference to the note on poisonous Legumes at p. 768, Vol. IX, *Gardeners' Chronicle* for June 15th last, I have been favoured with a letter from Robert Russell, Esq., of Government Park, Spanish Town, Jamaica, the facts contained in which may be interesting. The Cashaw tree of Jamaica is not a native but is said by M. Longue in his *History of Jamaica*, on the information of an old resident, to have been introduced about the end of the seventeenth or beginning of the eighteenth century from South America by some mules which were afterwards pastured on the plains then a prairie country, and they distributed the seeds by their droppings. All the plains between Liguanea and Vere are now covered with Cashaw trees. The wood is heavy and hard and when polished may be mistaken for Mahogany; it is a beautiful tree, and assumes various shapes according as it is grown, singly or in groups, or clustered in a forest. When grown singly the branches become tortuous, and can be dressed up into various forms for knees and ribs in ship building. When clustered, seeking the light, they

- grow straight to the height of 15 feet or more before branching and the wood is then used for columns, gate-posts, &c. It is the principal fuel-wood where it grows, and is largely consumed by the Jamaica Railway Company for their Steam-Engines. The Bean is excellent food for all quadrupeds and produces no injurious effect on cattle, sheep and goats: this immunity in the case of cattle, it is said, is because these animals chew the cud, and thus get rid of the gas. It is greedily eaten by horses, which fatten on it so long as it is dry, but a slight shower of rain, just sufficient to damp it, causes
- the pulpy covering of the seed to ferment, it then becomes sweet, and the horses eating it in that state have their stomachs distended, and if not attended to die in a few hours in great agony. The gas generated by the fermentation is said to be hydrogen (?), and I am inclined to think it is for my unfailing remedy is a champagne glass of the chloride of lime or soda mixed with water: these will altogether fill a wine-bottle, and are administered in two or three drenches at intervals of half or three-quarters of an hour or more. Shortly after the distention is reduced the faeces are removed by mechanical means, and the animal is relieved. The effect of the chloride acting on the hydrogen gas is said to at once absorb it,
- and to convert it into hydrochloric acid and thus reduce the distention. Many graziers store the crushed beans to be given to their horses in times of scarcity. It may be remarked that, when the bean becomes well saturated after a heavy rain, it gets sour and the animals will not eat it.

"I am further informed that the writer of the foregoing letter lost at one time some valuable horses during the wet season from Cashaw poisoning, but at the present time owing to his treatment as above described a loss from Cashaw poisoning is a thing unknown. Regarding the similarity of the wood of the Cashaw to that of Mahogany, the heart-wood is of a reddish brown colour, and not at all unlike some of the lighter coloured kinds of Mahogany. It is apparently also strong and durable."

Cultivation of the Arabian Date Palm in Oudh. (Communicated by the Department of Revenue, Agriculture and Commerce.)

With reference to the last paragraph of the Proceedings of

Letter from Oudh, No. 8047, dated the 28th August 1876 and enclosures.

the monthly general meeting of the Agricultural and Horticultural Society

Letter from N.-W. P. of India, which was held on the 19th and Oudh, No 1912, ultimo, I am desired to draw your attention to the circumstance that the Arabian Date Palm has been grown in Oudh. The papers noted in the margin show the degree of success attained in its cultivation during 1876 and 1877, and a copy is enclosed for the information of your Society.

SIMLA : } (Sd.) C. L. TUPPER.
9th October, 1878. }

From Personal Assistant to the Chief Commissioner of Oudh, in the Revenue Department, to the Secretary to the Government of India, Department of Revenue, Agriculture and Commerce, Simla, dated Lucknow, the 28th August, 1876.

I am directed to submit, for the information of the Government of India, copy of a report (No. 162, dated 10th instant) and its annexure by the Superintendent of the Department of Science, regarding the cultivation of the Arabian Date Palm in Oudh, during the year ending 31st ultimo.

2. It would seem that the plants are generally thriving; but at Bahraich a number died after being transplanted; and at Sitapur the plants are said to have suffered from drought.

3. Doctor Bonavia has been requested to inform District Officers of the most suitable time for transplanting, and to suggest to them the remedy for white-ants, to which he refers, and a report has been called for regarding the circumstances under which so many plants were destroyed at Sitapur.

Copy of a letter No. 162, dated Lucknow the 10th August 1876, from E. Bonavia, Esq., M. D., Superintendent, Department of Science, to the Officiating Secretary to the Chief Commissioner of Oudh.

1. I have the honor to forward herewith a statement, showing the number of Arabian Date Palms alive in all the districts of Oudh on the 31st July 1876.

2. The number stated to be alive in the districts appear to be thriving, excepting perhaps at Gonda and Bāra Banki. The former are said to grow very slowly, and the latter to be stunted.

3. At Bahraich it is stated that 59 died after transplanting. This appears to be a large number of deaths from transplantation. They must have been removed at the wrong time.

4. A certain number, especially in Sitapur, are said to have been killed by the last severe hot weather. Sufficient watering might have perhaps prevented such a large number from being killed at Sitapur.

5. The increase in some districts were caused either by errors of counting in the previous year, or by additions from Lucknow. The increase in the number of seedlings in the Lucknow Horticultural Garden is caused by a number having been left in a nursery to fill up any vacancies, and which were not included in last return. The majority of the Lucknow seedlings are in a very thriving condition.

6. Of the old sprouts all are thriving. Of the new ones a large proportion died in the nursery, not having struck, and a few of the weaker ones died after transplanting.

7. A certain number in the districts, and a few of the sprouts in Lucknow, have flowered; but it is quite premature to judge of their quality; (1st), because the plants are all very young yet; (2nd), because for want of pollen, the female flowers cannot be perfectly fertilized.

8. I have found the best time for transplanting to be either October or November, and Dr. J. Hart of Partabgarh has found the best time to be in October. He also states that the best remedy for white-ants is to water the trees with an infusion of the pounded leaves of the "Hathichighar" or Aloe plant, a species of Agave.

Cultivation of the Arabian Date Palm.

Statement showing the number of Arabian Date Palms on the 31st July, 1876, in the various districts in Oudh.

Districts.	Number alive on 31st July 1875.	Number alive on 31st July 1876.	Difference.	Average height.	REMARKS.
Fyzabad ...	156	178	+ 22	Not mentioned ...	Ten died and thirty-two germinated from seed newly sown. Those which are alive doing well.
Gonda ...	66	94	+ 28	9 inches to 6 feet...	The increase has been discovered since last year. Plants <i>healthy</i> .
Babraich ...	386	327	- 59	Not mentioned ...	Decrease caused by death after transplanting.
Sitapur ...	601	561	- 40	2 to 7 feet high ...	Decrease caused by deaths during last severe hot weather.
Kheri ...	249	249	...	Not mentioned ...	All thriving.
Hardoi ...	122	152	+ 30	1 to 11 feet high...	Increase caused this year; 7 error in counting last year; 23 young plants received from Lucknow in 1875-76.
Rai Bareilly...	518	518	...	2½ to 4½ feet ...	All thriving.
Sultaupur ..	420	417	- 3	6 to 9 feet. ...	Three died during last severe hot weather.
Pratabgurh ...	254	255	+ 1	Not mentioned ...	Increase caused by error in counting last year. Plants doing well.
Bara Banki ...	17	15	- 2	Not mentioned ...	Two plants killed by white ants.
Anao ...	286	329	+ 43	Ditto ...	Increase caused by that number having been unnoticed last year among a standing crop.
Lucknow ...	Seedlings. 325	393	+ 58	From 2 to 15 feet...	Increase caused by that number having been left in a nursery to fill up any vacancies and were not included in last return; seven plants are weak, all the rest thriving.
77 Old plants ...	Sprouts. 159	108	- 51	From 3 to 7 feet ...	The decrease caused by four young ones having died during last hot weather and the rest in

From CAPT. G. E. ERSKINE, Personal Assistant to His Honor the Lieut.-Governor and Chief Commissioner of Oudh, to the Secretary to the Government of India, Department of Revenue, Agriculture and Commerce, Simla, date Naini Tal, the 8th of September, 1877.

With reference to my letter No. 3017, dated 28th August 1876, I am desired to submit for the information of the Government of India copy of a report No. 237, dated 28th ultimo, and of its annexure, from the Superintendent Department of Science, Oudh, on the progress in the cultivation of the Arabian Date Palm, during the year ending 31st July 1877.

Report on the cultivation of the Arabian Date Palm, for the year ending 31st July, 1877.

Has the honor to forward the above for the information of His Honor the Lieut.-Governor, N.-W. Provinces, and Chief Commissioner of Oudh.

2. Considering the drought in most places in Oudh, undersigned considers the state of Date Palm cultivation not unsatisfactory.

(Sd.) E. BONAVIA,
Supdt., Dept. of Science in Oudh, Lucknow.

Cultivation of the Arabian Date Palm.

Statement showing the number of Arabian Date Palms alive on the 31st July 1877, in the various districts in Qandah.

No.	Districts.	Number alive on 31st July 1876.	Number alive on 31st July 1877.	Difference.	Average height.	REMARKS.
1	Kyzabad ...	178	182	+4 (not mentioned at all last year.)	Not mentioned	Are now living and appear healthy.
2	Gonda ...	94	69	25 died.	1'3" to 6'3"	Are now living and in healthy state. It was thought advisable to shift some of the Palms in the Government Garden to more suitable localities, but 25 regret to say died in consequence.
3	Baraich ...	327	273	54 died.	Not mentioned	Out of 273 Palms 116 are in an unhealthy or stunted condition.
4	Sitapur ...	561	570	+9	1' to 12" ...	The trees are all in a healthy state. Out of 40 Date Palms, which were supposed to have died the year before last, 9 gave fresh shoots.
5	Kheri ...	249	238	11 died.	Not mentioned	At present alive.
6	Hardoi ...	132	150	+18	3' to 13' ...	Nil.
7	Rae Bareilly...	518	512	-6 died.	3' to 6' ...	One tree fruited, but this being in the city it was found impossible to save the fruit as it approached maturity.
8	Sultanpur ...	417	417	...	Not mentioned	Still in existence. Some in a very flourishing state. One tree has borne a cluster of dates well formed and matured.
9	Partabgarh ...	255	258	+3	...	The number entered in last year's report, viz. 255 was not correct. The correct number of plants in district was 259. Out of this number 1 died during the year.
10	Panipat ...	15	15	...	Not mentioned	Still alive and thriving.
11	Meerut ...	329	285	-44 (not in m. list last year.)	Not mentioned	One tree in Jail Garden fruited this year, but

THE GARDENER'S NOTE BOOK, No. 18.

Notes on Tuberous Begonias; By SAMUEL JENNINGS, ESQ., F.L.S.
(Corresponding Member.)

THE Art of the Hybridist has, within the last few years, accomplished no more striking triumph than that of the improvement and variety which have recently been effected in the Begonia. No other genus has ever yielded so promptly to careful selection and afforded examples so far in advance of the original parents in so short a period of time, we have been presented in fact with a new flower of amazing capabilities, the full value of which we are only just beginning to appreciate. The season now closing (1878) has been remarkable in an especial manner for the prominent position which has been occupied by the new favorite, and the experience of many growers leads me to believe that it should also attain a high rank amongst flowering plants suitable for growth in India.

The old fashioned Begonias have been in cultivation for the last eighty or a hundred years and are well known in Calcutta. They originally came from China, and I have myself observed several species growing luxuriantly on moss-covered rocks in the Himalayas. They were admired for their bright glossy leaves, rather than for any particular beauty of their flowers. It was about the year 1858 that so great a sensation was produced by the introduction of the magnificent *Begonia rex* from South America, and the many varieties which were shortly afterwards raised from it were all in the direction of improved foliage, the flowers in all cases were insignificant. In 1864, '65 and '66, several new species were discovered in Peru and Bolivia by Mr. Pearce, Messrs. Veitch and Sons' Collector, the characteristic feature of which was the extreme brilliance of their flowers. Of these the first to arrive was *B. Pearcei* in 1864 with handsome foliage, dark green on the upper surface, and reddish beneath traversed with pale green nerves, the flowers bright yellow. This was soon followed by *B. Boliviense*, a beautiful species, having an erect habit with stem

and branches and axillary flowers, bright scarlet in colour, quite a novelty in Begonias. Then there came *B. Veitchii* discovered at an elevation of 12,000 feet above the sea, near Cuzco in Peru, stemless in habit, consisting of a cluster of dark shining leaves with conspicuous flowers thrown well up from the centre of the plant, a perfect blaze of intense vermillion.

Another charming species from the same locality and very similar in habit is *B. Rosaflorea* with pale rose coloured flowers, sometimes so pale as to be almost white. There are several others since introduced, such as *B. Frabelli*, with hairy leaves and scarlet flowers, and *B. Davisii*, a very dwarf form near *B. Veitchii*, with very rich scarlet flowers. It will be seen that these introductions started an entirely fresh departure for the Begonia which had hitherto been neglected as a flowering plant. "Such astonishing colour suggested improvement, and the result of a series of crosses and re-crosses has produced so infinite a variety that a writer in the *Revue Horticole* says that from the seed of one specimen of \times *B. Sedeni* fertilized from several varieties he raised twelve hundred plants of which scarcely two were alike, the variety of colour he obtained was surprising—yellow, magenta, rose, lilac, vermillion, and pure white. In habit too there is found to be great diversity, some examples partaking closely of the style of *B. Bolivense* and *Pearcei*, develop into handsome shrubs bearing very large and strikingly brilliant cymes of bloom; the tendency of others again is towards the dwarf-growing *B. Veitchii* and *rosaflorea*, but all are beautiful in their way. Constitutionally they seem to be very hardy; by this I do not so much refer to their being able to stand the cold of an English winter. As to their apparent indifference to temperature they flourish equally well in a stove. There is difference of opinion as to their capability of resisting a damp atmosphere, damp with cold they dislike; but I am assured, on reliable authority, that a damp warm atmosphere would

Notes on Tuberous Begonias.

• suit them very well, and it is upon this wide range of habit that I anticipate great success with them in India. In 1870 I imported a tuber of *B. Boliviense* in the gardens at Allahabad, but arriving in the height of the rains I failed to save it; if I remember aright it never started growth at all but simply rotted away in the pot. The plan now adopted in this country is to raise them from seed sown in January. In April the seedlings make rapid progress, in May they begin to flower, and continue in bloom till November, when they die down entirely. In India I should sow the seed in October, and I believe you may have flowering plants in March which will continue to bloom until the rains, when I fear you will lose them unless they are sent to the Hills as you sometimes do with pelargoniums; but if the plant shows a tendency to die down, the tuber might be carefully lifted, placed in dry sand, and stowed away till the return of the cold weather, when it should be re-potted. Experience will, however, prove more valuable than theory, and to enable you to give these charming plants a trial I send you some seed saved from the choicest varieties, which I hope your gardener will succeed in raising. While on the subject of seed sowing I may mention that a very successful Florist told me the other day that the secret of success in raising plants from seed was to effect germination *in the dark*. He always covered the boxes in which he had sown seed with a thick mat or cloth until the tiny seedlings had actually appeared, then he gradually inured them to the light, and he confidently believed that by adopting this plan he secured the germination of a far higher percentage than his neighbours.

• The soil that best suits the Begonia is a light friable sandy loam, they do not require much water, and appear to be capable of standing any amount of sun. Some of the erect varieties will propagate by cuttings, but they are difficult to increase except by seed.

M. Lemoine of Nancy, the celebrated hybridist, has raised

many interesting varieties, and amongst them some with double and partly double flowers. In its simple form a very great difference will be observed between the male and the female flowers, both on the same plant: the staminate flower has four petals, and the pistillate, five, though not invariably so, and very often in each trio of flowers the male will occupy the central position, and on either side will be seed bearing flowers. In the double form the monstrosity is almost always in the pollen-bearing flowers, in which the stamens have developed into inner whorls of petals more or less perfect, whilst on some plants both double and single flowers will be produced at the same time.

Some varieties of these tuberous Begonias are peculiarly suitable for planting in baskets: they assume a most graceful pendent habit and soon envelope the basket in wreaths of rich foliage and intensely coloured bloom.

If you should raise plants from the seed sent and in due course the plants die down, be careful to search well for the tubers as being very small and just the colour of earth you may very likely lose them.

1st October, 1878.

The Gardener's Note Book, No. 19: A few hints in connection with a Gardener's Note Book. By COL. W. H. LOWTHER.

THE *Horticultural Guide* required for India is a tabular compilation of everybody's experience and observation in the culture of fruits, flowers, and vegetable esculents, under the local conditions of each "climate," under which (1) prevailing winds, rainfall, temperature, and atmospheric phenomena, could be briefly stated: next, water-supply, wells and tanks, the chemical quality of the element especially noted. Lastly, soils, their depth and distribution, the local sources of manures, vegetable and animal, "General Remarks," culture and mode

of cultivation, with any particular protective treatment and full returns of results, season and date of sowing and planting, of flowering, of fruiting and seed bearing, special experiments recorded.

Years ago I kept a diary of garden operations, and my father did the same before me, on the *experientia docet* principle (this practical Guide was burnt at Cawnpore in the mutiny.) The book should be alphabetically arranged, and the sowings and all particulars regularly entered; I used sheet zinc labels attached with wire to bamboo pegs. On these labels numerals are written with chemical ink to tally with the names contained in a large pocket-book, from which the Garden Diary volume is daily copied at the desk.

The pocket-book columns are entered thus—

No. 74, Heartsease, Henderson's.

1st Sowing.

Germinated.

October 25th, 1877.

November 15th.

Flowered.

Seeded.

January 10th, 1878.

February 27th, 1878.

Best grown in pots and were watered with liquid manure composed of pigs' dung and water, but those in Mr. Smith's garden were better flowers on which *weak guano* water was tried. Heavy rains at Christmas suddenly pushed forward all my plants, and when they were unpromising and dwarf for their age.

This small sample of entry will furnish the required specimen for zealous amateurs. I give you the recipe for chemical ink:—Dissolve a little nitro muriate of platinum in distilled water,—rather an expensive chemical ink, but the only good one and will last for years; put the liquid in a clean inkstand with some cotton-wool therein; should the contents dry up, add a few drops distilled water occasionally: always use a *quill pen*. For permanent labels required for fruit trees, seedlings of shrubs, new roses, and such like, use sheet lead

in length and strips; keep a set of steel letter and nuncher punches, with which mark your tallies and attach with wire to the branches. The common bamboo tallies cause loss and disappointment, they rot or are devoured by white ants. I recommend all Horticultural Institutions to send out printed forms, alphabetically arranged, with all the above-mentioned headings to be left *blank* for filling up by the growers, especially in India, where climates and all their conditions are numerous and variable. To illustrate my object I will give a few instances: Jubbulpore and Benares are only 300 miles apart. At the first-named humid locality, artichokes do not thrive, while the French Bean can be sown in June, yielding enormous returns; while here the reverse occurs. At Jubbulpore, caladiums, achimenes and gloxinias attain perfection in the open stage: here caladiums have to be carefully tended under cover. Achimenes are poor specimens, and gloxinia will not even flower—it merely exists!

I think I have now given a useful hint for the improvement of horticultural knowledge. The three Presidencies, if uniting their labours in the above simple manner, would be enabled to produce a joint Encyclopædia of gardening in India, such a book as would be the most practical hitherto published.

The Gardener's Note Book, No. 20: A novel mode of putting down cuttings of hard-wooded plants. Communicated by
T. M. FRANCIS, ESQ.

THERE is an article in the October number of the *American Agriculturist* regarding a novel mode of putting down cuttings of hard-wooded plants (*e. g.* grape-vines) which the Editor says was communicated to him in 1866, by Mr. Wm. Patrick, a nurseryman at Terre Haute, Indiana. My first idea was to try the process myself, and if it proved successful

to communicate the result in the form of a paper for the Society; but on second thoughts, I have determined to give a brief account of the process, in order that all members of the Society, who take an interest in matters of this kind, may try the process for themselves, and then compare notes either by letter or through the Society's Journal, always bearing in mind Dr. Carey's motto—"A body of men engaged in the same pursuit form a joint-stock of their information and experience, and thereby put every individual in possession of the sum total acquired by them all."

Mr. Patrick's account of his process is intended only for countries where (as he says) "the ground freezes," and the only plants which he mentions are grape-vines. But I am inclined to think that with slight modifications the process might be used with advantage in this country, and that it would apply to all hard-wooded plants, *e. g.* roses. The process, with the modifications which I would suggest, is briefly as follows:

Make cuttings from four to six inches long, with two leaf-buds on each. Tie them loosely in bundles of about fifty each. Dip the lower ends up to half the length of the cuttings, in a mixture of clay and cow-dung, such as natives use for smearing over the floors of their houses. Then put the bundles of cuttings *bottom ends uppermost* into boxes about a foot deep, rested on bricks to keep off white ants with two inches of ordinary garden soil at the bottom of each box. Sprinkle in fine earth so as to fill all the spaces in and between the bundles of cuttings and then fill in enough earth to cover the ends of the cuttings to a depth of four inches. Water them slightly, cover the earth with a layer of straw, and put the boxes in a place where they will get the morning or afternoon sun. In about five weeks the cuttings will almost all be found to have formed roots, while the leaf-buds have swollen and are just ready to burst. The cuttings now require careful

handling and should not be allowed to dry, but should at once be planted out, top ends uppermost, with the upper eye just above the surface, the soil being firmly pressed down round them.

Mr. Patrick also describes a mode of putting down cuttings in the open ground; but I think boxes would be preferable in this country.

At first sight, the above process seems contrary to nature, and therefore absurd; but a little thought will show that it is based on sound reasoning. It may be taken as an axiom that in putting down a cutting the gardener wishes that it should form a callus and emit roots *before* the leaf-buds push forward. This desideratum can be secured by the use of bottom heat; but only a select few can afford the trouble and expense which this entails. Most Indian gardeners (if I may venture to speak from my own experience) put in their cuttings without bottom heat, and find that though the leaf buds push forward freely, the cuttings are apt to rot off from the base. By Mr. Patrick's method, the sun is made to furnish bottom heat, while the leaf-buds are kept in a dormant condition.

I am about to try this process myself, and trust that other members of the Society will do likewise, and will communicate the result of their experiments.

Report of the Comparative working of certain Ploughs.

BY DR. S. LYNCH.

I RETURN herewith the plough you were good enough to lend me for the purpose of testing the draught when used on the light soil of the field attached to the Alipore Jail. The plough is one of Ransom's very light ones, its weight being only 84 lbs. The depth of the furrow was between five and six inches, and the width about seven. We found the draught when the plough was drawn by a pair of bullocks at their

22 *Report of the Comparative working of certain Ploughs.*

ordinary place, was between $2\frac{1}{2}$ and 3 hundred weight on land from which a crop of millet had just been cut. The bullocks used were average country animals, well fed and accustomed to ploughing. The plough, with the same bullocks, was also tried on grass land which had never before been turned up,—the site of an old village. Here the draught was as much as 4 cwt. to $4\frac{1}{2}$ cwt. This was as much as the bullocks could manage, walking very slowly, and they could not have done a day's work at it. The land was wet and heavy.

The work of a native plough was compared on the same grass land, with that of the English plough; the draught was found to be $1\frac{1}{2}$ cwt.: such a trial is of little use, as the native plough is not intended to accomplish its end in the same manner as the English plough. It scratches the ground, and has to go over the same surface repeatedly to get to the depth which the English plough reaches at once. *

One result of testing the draught of the native plough was that we found that bullocks, such as are used here in native carts, are equal to a draught of $1\frac{1}{2}$ cwt. Anything more brought them to a stand-still. The work done, therefore, by the native plough is equal to the capacity of the country bullock when half-starved in the hands of the poor native.

We also compared Ransom's plough with an American wooden beam plough with wooden handles made at the jail from a pattern you were good enough to lend us. This plough weighs about 56 pounds (the weight varying according to the kind of wood used.) The ploughshare is a bar of wrought iron, made to shift towards as the point wears out. This plough turning the same furrow as to depth and width, as Ransom's, but a broken one, whilst with Ransom's the work was beautifully even, the slice being turned completely r showed the same draught as Ransom's.

Comparing the two ploughs as to cost, the American plough can be made here at from Rs. 12 to Rs. 15, whilst light English ploughs for a single horse or pony cost, at home, from £ 2-10 to £ 3, or, in this country, from Rs. 45 to 50. The difference then is altogether in favor of the locally-made wooden plough, which turns out just as efficient work, though not so good to look at as the English one,—which is far lighter—56 lbs. against 84 lbs. and can be made at one-third of the cost of the English plough.

*Notes on the Kookee Jhoom Cultivation; BY C. BROWNLOW, Esq.,
Corresponding Member.*

WHILST engaged as Manager of one of the outlying Tea Gardens of the Cachar frontier during the year 1874, there was a village of Kookees, who lived about three miles off the garden; they were Jhoomers, that is to say, they subsisted on a desultory system of cultivation, cropping the land as long as it would yield and then deserting it for other tracts. In this respect differing from the alluvial cultivators or people of the plains who worked their land as an heritage to be bequeathed to future generations.

These Kookees being in want of a piece of jhoom land, and I having a quantity of spare land which was not required either immediately nor prospectively as far as I could see for purposes of tea cultivation, we came to a mutual arrangement. I gave them a piece of about 300 acres, and the service demanded of them at an equivalent was, that they should give me as many hands as I demanded during the heavy flushes so as to enable me to take off all my leaf.

This is a contingency with which all Tea Planters are familiar and against which many provide in this way, that there are certain times during which stress of work is certain to occur in every manufacturing season, during which the ordinary allowance of plantation labour is quite insufficient, and in order to meet the exigency a great many extra hands must be brought to aid; these stresses do not last for many days, and although they recur it is at considerable intervals—a fortnight and more. As the jhoom tract thus assigned was close to the garden I had frequent opportunities of visiting it and acquainting myself with the work in all its stages, and the notes and sketches I made from time to time I now throw together, and though

the account has no doubt lost in detail owing to lapse of time, such as it is, I send it for what it may be worth.

It is an additional incentive to me to give such an account, as I am able, of this mode of cultivation, for the reason that, although I have seen many descriptions and as far as they went good descriptions of it, I have come across none that gave an adequate idea as a whole, without which view the rationale and method of it, for method it undoubtedly has, although it is wont to be considered desultory, and unsystematic, necessarily fail to be appreciated.

In the subsequent description I consider it best to adhere as far as possible to actual names of localities as well as of individuals, in order as far as possible to convey the impression of reality to the minds of readers.

The land assigned to the Kookees and on which they lost no time in commencing operations, must next be described.

It was of a mixed sort, being neither altogether upland (tikor), nor yet all low land (thull), but consisting of both in certain proportions.

The land lay along a stream—the Jalingacherra—and was a good deal of it bottom or alluvial deposit of said khal, but there was also interspersed throughout it hills, hillocks, and ridges, and also mere humps or hummocks of upland, all of which were put under cultivation, each in its own appropriate way, so that the whole sandy, loamy, clayey, and puddley was united into one unbroken tract of cultivation.

The hills were of a low elevation close to the khal and increased in height as they receded from it.

The alluvial tract in which these hills were set had a slope from the margin of the khal where it was highest towards the interior, and wherever it encountered the hills the level dipped still further so as to form a sludgy morass along their bases. Wherever also the alluvium was surrounded or even partially so by hill so as to form a bight or basin within, the silting was still further obstructed, and a small lakelet (unmoosa) was the result, covered with floating grasses (dhull) and margined with the mat rush (moorta), as well as other dwarfer sorts: these were the only portions left uncultivated.

The soil on the immediate margin of the khal was loamy and open; but look on the character as it retreated of a heavy blue clay stiff and tenacious, and such as dhan loves to grow in. The entire alluvial tract under consideration was sufficiently removed from general inundation level to be out of reach of actual floods at that level. But nevertheless backwater exercised sufficient influence to make the shelf inundatable for short periods during heavy freshes, and the same reasons suffice to explain the nature of the jungle growing on it which was forest and not grasses, ekur, khag, &c., such as grow out on the plain.

The entire alluvial tract forming portion of the jhoom was of the sort known in the district as alluvial forest and not—or at any rate very little of it, and that at the lower or more expanded end—bheel grasses. This necessarily implies that the land was situated some way up the khal, on higher levels than that where it met the general inundation mark of the country; it does not however equally imply that the land was in no degree subject to inundation. The fact being that it was subject to it, but that only at certain intervals, and then for a few hours only at a time, such land having as this had a well-defined slope and being therefore tolerably well drained, comes up naturally in forest, differing somewhat, but still not very greatly, from hill forest and consisting of large forest trees and bamboos growing together in some places, the one prevailing, and in others the other.

In order for bheel grass to prevail, the conditions are necessary, either that the land should be within influence of high flood mark, or else it must be surrounded by hill land, or as it were within a bight of teelahs (small hills), these are of frequent occurrence and are called towars; in these the only exit for drainage is out through a single opening which is sometimes much constricted, and has furthermore a tendency to silt up more just at the mouth than elsewhere. Thus the back part gets thrown into a condition of insufficient drainage, and is then if much flooded an unnooa as previously explained, or if less so a towar, and is then clothed with bheel grasses.

The land generally consisted of the finest virgin forest, which had neither resounded to the blow of the woodman's axe, nor had ever been subject to the ravages of the bamboo cutters.

The trees were all tall and stately and true in form and running up branchless to their full stature, and without either scorch or scar the bamboo clumps were of very large girth containing many of them as many as 1000 bamboos, all of the fine large sort, (known as Doloo bamboos) light, thin in substance, and large in bore, long jointed, and each joint as truly cylindrical as if it had been turned in a lathe; they all shot up to use a similitude scarcely overstrained like a stand of rockets, each drooping over at the end, where it thinned off into a mere whip lash with its wisp of lancet shaped leaves at the tip.

Each clump was surrounded by numbers of the carcasses of defunct and half-decayed bamboos of the past generation which lay around, as well as protruded from it at all angles forming an apparently insurmountable barrier to approach, only apparent however as the mere tread and in the case of the more decayed ones the mere touch was sufficient to send each crashing down in pieces.

The hill-forest consisted of the usual intermixture of large and lofty trees whose heads reached to a good height, and of those of smaller growth whose heads formed a sort of understratum of shade.

Among the larger sizes of trees the most noticeable were wild mangoes, wild jacks, myrtles, and spongy-wooded *Sterculias* of very large stature. A large number also consisted of those curious forms that cannot fail to strike the eye and are a prominent feature of these India forests. The epiphytic figs with their curious trunks, pillared knotted, cross-laced, and buttressed in the most fantastic forms, generally hollow all through, owing to having moulded themselves on the bodies of other jungle trees. The climbers scarcely noticeable beneath where they took root were far from being so above, drooping in festoons from tree to tree and assuming even more extraordinary shapes than the trees themselves, corrugated spiral, corkscrew shaped and whorled in places possessing the utmost regularity of form, in others huge and irregular. Here is a piece of *Mimosa scandens* (gela lot) with its great sword-shaped pods and bark red and rough-looking where it droops across an opening in the underwood not unlike an agonized serpent.

The low land-forest consisted in great part of a sort of resinous tree (Mohal); the wild betel palm* (Ramgood) also affects this sort of land and stands thick all over it, sending up its elegant form straight as an arrow, streaking the dark background with its line of white, and displaying its clusters of redberries beneath its elegant head.

Other forms there also are that of the wild Palmyra and various other palms, as well as their imitators in symmetry and form—the canes; there is the enamelled green of the smaller cane producing by intermixture of the leaves, the most delicate effects in cross-hatching.

The great Gulla cane seems an idea borrowed from the coconut palm and with the same gigantesque leaves; there is also what looks like an areca palm drawn out fine and sprinkled over with prickles and tentacula. Spoke leaved palms, holding their wheel like leaves at the ends of their long curved branches, and in some dark hollow overhanging the stream, the multifold leaves and curly new growths of the tree fern.

The Kookees having obtained permission in January forthwith proceeded to squat on the land, and first and foremost engaged themselves in building a sort of shed or bothy, containing ample accommodation for all the hands who should be engaged in the clearing: this was a long low shed with the eaves running down nearly to the ground, just high enough for a man to walk down the middle and no higher. On both sides was a

* This is not at all unlikely the wild congener of the village Betel Palm, is exactly similar in all respects, only of a slenderer and more fragile build.

machan or platform, a couple of feet off the ground; it was made of entire bamboos laid close to each other, and covered with turza or bamboo matting. This was wide enough to allow of the men sleeping crosswise. The materials of this shed were all at hand, and it was surprising how quickly a few hands slashed into the bamboo clumps and ran up the rude but comfortable edifice; the walls as well as front and back were of whole bamboos set close together.

The building having been finished, the men went away to the village and returned with their pick-a-back baskets cram full of the most miscellaneous articles, cooking pots, wooden platters, water-gourds, bamboo-joints, and bundles of sundries done up in rags, and of some the pyramid of sundries perhaps crowned on the summit by a fowl as a sort of presiding genius.

The bothy was henceforward to be the abode of the young men until the building of the jhoom lodges gave them other accommodation; they seldom went to the village except for some grand feast or celebration.

Between the intervals of work all the hands of the village might be found assembled here pursuing their various avocations; some mat or basket, or fish-trap making, others cooking, and others again making snares for wild fowls: some are engaged in nothing more arduous than sprawling at their ease on the platform, and amidst all there is a running fire of jokes, songs, and chaff.

January mornings in these jungles are bitterly cold: there is a constant drip—drip—drip from the trees all round like that of rain, and it is some hours before the sun can assert himself so as to dissipate the heavy mists of morning. During these hours the animal creation are in a semi-torpid state, and the Kookee also partakes of the same condition and wrapped up from head to foot keeps studiously in the vicinity of the cheerful blaze which lights up the bothy. Wherever else wood is an article to be husbanded here at all events there is no stint, for is there not an entire forest to draw on, and the only consideration that suggests a limit to piling up of the logs, is the house being low as well as itself of a combustible nature.

When Sol has advanced his burning eye to a sufficient degree to clear away the heavy morning mists, everything puts on a different aspect; where all was before a gray and nebulous gloom, is now lighted up by flecks of sunshine which find their way through the leafy masses overhead. The birds have found their voices and fill the whole forest with their morning strains; one recognizes the pure liquid notes of the shwami, the chattering of the bheemraj, and the wonderful ventriloquism of the hill-mynah, and wonders how notes so various can be made to issue from the same gullet. Now a melodious whistle and anon a deep reedy note like that of a clarionet; one also hears the impa-

tient bark of the black squirrel and the resounding tap of the wood-pecker on the hollow and decaying tree.

When suddenly without the slightest sound or anything that might serve as prelude to such an entertainment, there is from some point overhead not very far off a sudden and startling burst of the most unearthly harmony, hooray—hooray—hooray; wha—wha—hooray—hoorah, and so on for a good ten minutes; but there are limits to the powers even of the most powerful lungs, and at length there is an intermission.

A short interval of silence and there they are at it again, hooray—hooray. There can surely be no mistake about it. This is a sylvic concert with probably some lunatic operatic performers escaped from Bedlam for performers. There goes the conductor with her baton leading off with three loud shrieks, and there they go again, hooray—hooray. Now they have lost their time and keep getting in one another's way each in her frantic efforts to outdo the other, and there they are all together again, hooray—hooray, and what voices, loud, clear and ringing as that of the most powerful alto that ever thrilled out her notes to an applauding audience.

With the birds and long armed apes thus singing all round him, the Kookee catches up his *dhou* and goes forth to play his part in the great orchestra; his cutting instrument is to him of great value, and he displays his affection for it by keeping its edge always rubbed up to a degree of keenness, worthy of a razor, with a small pebble of hone-stone that he keeps in his waist for that purpose. Having reached his work, he and his fellows work steadily forward in a row laying down the jungle behind them, keeping up all the while a low monotonous moan, so that on approach as far as the ear can inform, one might imagine them to be a row of fever patients in a hospital instead of vigorous men engaged in what should rather be an exhilarating exercise.

Whether this moan is to some extent a relief to the tedium and arduousness of their task I know not, but certain it is that all these Jhoomers have this fashion of giving vent to their feelings. Here is Pa-khoop engaged with a clump of bamboos, let us watch his *modus operandi*: one thing is observable, *viz.*, that he is in no hurry and does not spoil either his *dhou* or his temper by violent blows. Another thing also may be perceived, *viz.*, that even in such a thing as cutting bamboos there is a method, and one way of doing it is preferable to another.

He takes hold of the bamboo and pulls it over towards him, inflicting cut No. 1, somewhat high up and abreast of him. This does not sever the bamboo which in the first cut has a tendency to grip the *dhou*, and is therefore only partial. It has however the effect of releasing the reed from its state of tension, and the next cut just above the first goes easily through and severs

it. The upper portion is then laid back evenly along the ground; and now the stump, still remaining, is in its turn laid hold of and similarly pulled forward, and with a few chops cut off close to the ground; a single cut is here insufficient since the bamboo has more substance below than it has above. Thus a clump that has been well-disposed of shows only a number of short stumps standing out of the ground.

It is worthy of notice that a clump of this particular sort of bamboo may also be disposed of *by means of fire only* by making use of the dead bamboos lying about the clump, and therefore an entire clearance may be made (wherever this happens to be the prevalent kind of bamboo) *through the sole agency of that consuming element*. In the present year's jhoom-operations I saw the Kookees apply this method to particular clumps, but it is more tedious, and it is therefore considered preferable to cut the bamboos down first. The *modus operandi* in consuming a green clump is as follows:—the dead bamboos which can easily be broken by striking them against a tree, or by treading on them, are fed into a fire made in the centre of the clump, as the fire gains strength, the green bamboos burst, fall, and become detached and can then in their turn be fed into the flames until the whole are consumed. This method is of no practical use as jhooming is conducted in the present generation, and furnished, as all Jhoomas are, with *dhaus* of good steel; but it is worth knowing as showing the possibility of cultivation without implements of steel or indeed of any sort, and it must have been by some such method as this that the earliest cultivators of the soil, previous to the discovery of iron, raised their crops.

This mode of cultivation by fire applies, be it understood, to virgin-forest alone, and is not possible with any other kind of forest; not where the trees have been much cut down and the primitive growth has been replaced by a close scrub, for here the bamboos have dwindled down and yield no large quantity of debris, not sufficient to consume them with; they also have a tendency to throw out a profuse fuddy grass like growth at the base as if under the humiliating conditions they had some idea of reverting to herbage.

It is also not possible in tracts covered with tillering bamboos; the presence of this bamboo implies previous cultivation, its roots run under the soil, and it does not confine itself to clumps but spreads to any extent. In these tracts the bamboos are too wide apart to be consumed by their own debris.

Neither is it possible in the sort of forest in which the outer plains naturally come up, *viz.*, the tall grass and seed called *ekur* and *null*. In these tracts, and especially if the land be rich, the accumulation of debris is not deficient, and fire aided by some wind will make a very clean sweep of the whole. This

Notes on the Kookee Jhoom Cultivation.

in fact is the mode in which a great deal of mustard is cultivated in the district, where an elephant is sometimes made to tread the jungle down first so as to make it burn off the cleaner; still this sort of clearance is only adapted to the raising of dry weather crops, and not for all the year round cultivation in order to accomplish, which it is absolutely necessary to extract the roots which cannot be done without iron.

This may seem something like a needless digression, but it is not unimportant if from other considerations than geological ones it contributes to show that the earliest seats of the human family were at the heads and not at the mouths of tropical valleys, such as that of Cachar.

A question however still remains, *viz.*, that if these early cultivators succeeded in clearing the bamboo off their lands by means of fire alone, still how did they contrive to dispose of the boughs of forest trees, of which there is a fair intermixture in every bamboo tract whatsoever? Suggestive of an answer to this is another question. What was the use made of the stone hatchets that are being constantly found all over India as well as Burmah? I do not assert, but merely suggest, that one of the uses they may have been put to was that of hacking or chopping the boughs to a sufficient degree to enable them to break of their own weight; and that this purpose, a very important one in jhoom cultivation, could be accomplished with such means, I think admits of very little doubt, although it is equally certain that neither trees nor jungle could be absolutely felled by them;—but a truce to speculation.

Custom has made it a rule amongst Jhoomers to fell all the undergrowth of timber, and no saplings nor moderate sized trees—as it is such that constitute the undergrowth—are left standing on a jhoom. These are easily felled which is one reason, and another is, that being small they dry well and burn entirely away, or if they do not, they at all events do not encumber the ground to any great extent so as to interfere with cultivation as the large trees do. These latter being also very laborious to cut, are therefore left standing, the bad effects of their shade being obviated in a way I shall presently mention.

Some trees there are which are strongly buttressed all round so as to make it too laborious to cut them down at the ordinary level at which a man can cut; in such cases a light platform is built against the tree so that the axeman can, standing on it, reach a part of the trunk above the buttresses. I have also seen this done by planting a stake ladder-fashion against the tree. This plan is adopted when a bough or bifurcation, a short way off the ground, presents a “coign of vantage” for placing one foot in; the other is planted on the ladder or stake. The object of this procedure is also to get at a part of the tree of a lesser girth than at the ground.

In the case of very large trees which felled would encumber the ground too much, and more especially if these present natural facilities for climbing, it is considered preferable to send up a man to lop down the boughs; this is done by the man sitting on the bough itself and cutting in front of him. The position is certainly somewhat constrained and does not afford much choice of attitudes or play for the limbs, a trifle too much energy thrown into his action might have the effect of precipitating himself instead of the bough to the ground. I have heard of such accidents on which men were maimed and even killed, but they are extremely rare, as the Kookee is an accomplished climber and a good holder on. In getting up he cuts with his *dharu* notches above him in which he successively plants his great toe and so ascends, and his descent is made in a similar way.

Jhooming time, so far from being a season of unmitigated labors to the Kookee is, on the contrary, one of considerable enjoyment. It occurs at a time of the year when the rains, which made these forests so unpleasant, have their trimesial intermission. The leeches are hybernating, and are no longer to be seen stretching themselves out tentatively from leaves and twigs towards the reservoir of blood they feel to be approaching, nor measuring their length along the ground in the eager hope of soon regailing themselves. The mosquito has for a while disappeared with his shrill trumpet and lancet. Midges are in abeyance, and the temperature is such that the hardest work causes no exhaustion or sweating.

This is the season for hunting, trapping, and fishing, and as all these pursuits are carried on simultaneously with jhooming and are supplementary to it, the subject would be wanting in completeness if I failed to allude to them.

Entering the bothy at a somewhat advanced hour of the morning when its inmates have recovered from their torpidity and have left the vicinity of the large fire—left smouldering on the hearth—we find our acquaintances variously engaged. Thang-a-pa is busy manufacturing springes for wild fowl. Mang-tay is with great care and deliberation laying up a rope out of strips of bark of the aloes wood-tree, setting the plaits together firmly and evenly for the heavy duty they will have to perform in holding back the struggling deer. Aphong is paring down the edges of the bamboo dagger, which is destined some fine night to lay the great hoompi* himself low as he roams the thickets. One of the lads is weaving fish baskets, to be set in the neighbouring khal and turned out each morning for its contents. Others of the lads are out in the neighbouring

* Kookee name for the tiger.

thickets inspecting all the springes, collecting all the game that has been caught, resetting those that have been sprung; the game thus captured consists of wild fowl, pheasants, and partridges.

Aphong, who has just been introduced, is an elder of the village, and bears the reputation among his fellows of being the greatest hunter and trapper among them. In the trackless depths of these gloomy primeval forests of Eastern Bengal, he is a pleasant companion and an invaluable guide, habituated from childhood to all the various phases of jungle life. 'His faculties of hearing, of sight, and of smell are sharpened to a great degree of keenness, and his readiness in emergencies and the quickness of his powers of inference are no less remarkable.

With his long light and well sharpened blade set in its curved handle of bamboo root, he is prepared to cope with any difficulties and will chip and chop a way for himself through the densest tangle. It is quite refreshing to see the easy familiar way in which he deals with that formidable climber the cane, a plant which seems the very embodiment and utmost effort of what nature could do in the direction of creating a nolime-tangere. The ground around is strewn with its penetrating spines, which also lie in ambush beneath the muck for the feet of the unwary traveller; the stem and midribs bristle with them to a no less degree for the benefit of his fingers, and lest he should be in too great a hurry, there are provided delicate things depending from above ready to hold him back in their clinging embrace, or to snatch off his hat and hold it in mid air, as though unconnected with surrounding matter by any perceptible tie, and the very leaves seem as if they had made an attempt to break out in thorns, but had got no further than a few harmless bristles.

This vegetable porcupine has no terrors for Mang-tay, who with gloves on his hands and protected as to his feet by a pair of cane-slippers, proceeds to drag down the monster from his attachments aloft, and as each successive leaf comes down it is stripped off together with its bristly sheath, with an adroit movement of his knife, until there lies at his feet a coil, smooth, white, and innocuous whith, having taken to the bothy, he will have occupation for several days in splitting and paring down for ties for houses, and fifty other uses.

Well does he know the times of fruiting of all jungle trees and is not a little beholden to them for his sustenance. The large imbricated fruit of the *Dillenia*, that of the Mountain Jack, the large pear-like fruit of the *Willoughbeia*, not to be got at without perilous climbing, all afford him refreshment in the jungles and not unfrequently a meal. The just opening ruddy blossom spathe of the wild plantain, and the tender new shoots of the bamboo, like some giant asparagus powdered over with

its coat of siliceous down, he cuts down, holding it first with a leaf to protect his hand from the penetrating needles, and rubbing it well with bamboo leaves, it is then in a fit state to go into his cooking pot. Other articles also he knows, the excellent qualities of the tender tops of the *Urtica urens*, the unfolding volute of the fern, and the white and delicate joints of the unripe cane.

The gigantic tuber of the wild Yam, buried far down beneath the surface and not to be got at without much digging, is nevertheless revealed to his penetrating eye, and after working half the day and excavating a pit large enough to bury himself in, he walks home with his burden on his head and a smile of satisfaction on his features, for has he not laid in provision for himself for many days? At a few minutes notice he will have equipped himself and be in perfect readiness for a day's—nay a week's sojourn in the jungles. His basket hangs at his back supported by its forehead strap, and the load can, when fatigue demands it, be at once shifted to the shoulder board. Contents—a cooking pot, a small bamboo joint containing salt or ashes, another ditto rice and capsicums, a cloth for the night rolled up into a tight ball, and made impervious to rain by means of a covering of palm leaves; and lastly he on no account neglects his flint and steel, together with a supply of the very sensitive tinder from the leaf sheaths of the *Caryota urens*, which in order to ensure its keeping dry, he stuffs into a seed taken out of a pod of the great Mimosa Bean.

Whilst jhoom-cutting is going on, the ear is constantly saluted with the sound of the axe and the crash of falling trees; the work having now been going on for several days, let us go out and inspect the operations. Previous to the jungle commencing to be cut it was possible with some degree of inconvenience in sundry places to make one's way in any direction. But this is no longer possible, and one is constrained to observe the paths that have been made through the cut jungle by the Kookees to enable them to get to their work, and even then it is no level path one has to go along. There are frequent obstacles in the shape of fallen trees that have to be surmounted. These are sometimes too high to be stepped over, and in such cases a ladder is placed against the log or an inclined plane made of two or three saplings lashed together.

Looking over the semi-dried and desolate expanse of cut jungle, I discern in the distance the man Hak-pooi-voo at work, his moans come floating across at intervals. Let us go and see what he is about. Hak-pooi-voo is one of those dark muscular rugged featured men of whom one sees some in any Kookee village. He is dressed in the simplest manner possible, a narrow fringed turban cloth, and not of the cleanest, wrapped round his head, from the folds of which large quantities of straggling

unkept hair make their escape; sticking out from his top knob, a bone-scratcher wherewith he now and then "unsettle the thick plantations" of his nameless tormentors and then replaces it.

For the rest his dress is as simple as it could well be, consisting of a string round his waist, in which is tucked a *lengti* falling in front in the form of a small square of cloth. The large silver earhoops, to the measure of which his earlobes have been distended, being only worn on occasions, and he being now in undress, have accordingly been taken out and put by, and the lobes wanting their usual distention, fall flabbily nearly touching his shoulders. His manner is perfectly unembarrassed, and on our approach he stops his work and surveys us benignly scratching himself with his axe in an expectant sort of way as if waiting for us to declare ourselves. The particular job he is engaged on just as present is that of bringing down a group of trees which are all bound together with climbers and so mutually connected that they may all be brought to the ground together by the onslaught of some one of the number judiciously selected. All the minor trees of the group have been cut through to the requisite degree, to enable them to be borne over, and Hak-pooi-voo is now engaged on the principal, a stout *Artocarpus*, standing bent over at a considerable angle towards the group. This has been so far severed, that it is beginning now to go of itself, and the remaining fibres of the heartwood unable to bear the strain thrown on them, are giving way in successive detonations. A few chops more and the monster loses his balance. There is a confused and deafening smashing and crashing, and in a few seconds the entire vegetable conglomeration lies prostrated on the ground impervious to anything save a squirrel. It is a grand sight whenever in the subsequent firing the fire reaches spots like these, for it then gains augmented fury, sending up volumes of dense smoke, the flames mounting up as if they would fain reach the skies.

Firing the jhoom, however, is an operation in which the Kookse is in no hurry to engage. Experience has taught him that nothing conduces more, to a successful year than a firing put off to as late a period as possible; burning off too early, and whilst the jungle is still in an imperfectly dried state may defeat all other operations however successful, entailing an infinity of labour to get the ground cleared—entailing a needy and foul state of the land in a subsequent stage, owing to the fire not having full play, and losing a quantity of fertilising ashes which would otherwise be distributed over the land.

Leaving the jungle therefore for the present to undergo a due degree of desiccation, let us see how the Kookses are engaged during the interval, and until the demands of cultivation give him no leisure to attend to any other avocations.

During this interval hunting, trapping, and fishing, occupy a good deal of his energies, and these pursuits are carried with quite as much method as the cultivation itself and are concomitant with it: any thing professing to be a full description of the one must necessarily take some notice of the other also.

All the contrivances in vogue display considerable and many of them consummate ingenuity. The traps for wild fowl have already been alluded to, they consist of a noose made of the smooth elastic horse-hair like fibre of a species of palm. There are different constructions of trap, but in the most approved sort the noose is set not directly on the ground but a few inches off it, where it is scarcely visible, three pegs on which it is stretched, give it a triangular contour. In the centre of the triangle and on the ground is placed a small catch which, on the bait being touched, releases the noose which flies up and takes the fowl by the neck. The agent of tension is generally some small sapling, the head of which is lopped off so as to cause less resistance in its backward spring. The best bait is considered to be a small seed which the Kookees call the Looshai seed: it is a hard shelled seed of a red colour and is considered more enticing than anything of an eatable nature. It seems as if the fowl only peck at it and that it operates on their imaginations in the same way as artificial flies do on certain sorts of fish: the same seed serves to catch a dozen or (since it undergoes no wear). Even more of the birds, jungle fowls, are also caught by nooses at gaps in artificial hedges and fences through which they have a natural instinct to make their way. Partridges and pheasants are also caught in the same nooses as those set for fowl.

In the vicinity of the jhoom appertaining to a large Kookee village the adjoining jungle for a mile and more around is set with snares, and the number of birds caught daily during the season amounts to perhaps a dozen. Porcupines and badgers are also frequently captured, deer being more rarely met with are not so frequently trapped, but nevertheless a feed of venison all round is not an uncommon occurrence in the village.

The deer snare is identical in principle with the wild fowl snare, but of course of a larger size and stronger construction; the noose is made of a well-twisted bark rope, it is laid on the ground and is drawn up by a powerful sapling. In the deer-trap there is this provision to ensure the deer being noosed high up on the thigh, *viz.*, a small pit dug in the ground in the deer's path; around this is laid the noose, and the pit is covered with pieces of bamboo laid longitudinally over it and masked with earth. When the deer puts his foot on the bamboo platform it gives way and lets it through at the same instant releasing the noose which, owing to the false step thus caused, has time before the deer can recover himself to take him high up on

Notes on the Kookee Jhoom Cultivation.

the thigh. Were the noose to be set on level ground the deer might still be caught, but might be so low down on the limb as to enable him to get free; there is a provision against his biting or gnawing the rope, viz., a tube of bamboo, which the moment the sapling starts is released from its position somewhat high up on the rope, and immediately slides down on to the knot and protects the part above it as far as the deer can reach.

Wild pigs are also caught with the noose, but the contrivance that answers best with them is what may be called the leg-breaker, a name which indicates the mode of its operation.

• In places frequented by pigs, which are great night-prowlers, there is constructed a long light-fence quite continuous and without break over hill and through hollow, for it may be a quarter of a mile, and in a direction across the travel of the pigs as indicated by their tracks.

When the pigs in the course of their nocturnal peregrinations meet this fence they do not, as they easily might do, break through it; but being more obediently constituted keep along with it, no doubt with the motive,—for even pigs have motives,—of turning it, or else finding a gate or opening of some sort. Now comes the gist of the contrivance. Openings there are provided for him to get through, not one but several at moderate distances from each other, and these openings are sufficiently contracted to afford bare room for his body to pass.

• In each opening a trough is laid square with the fence made of two pieces of split timber let into the ground, parallel with and presenting towards each other sharp edges like those of a pair of shears overhanging the said trough, and at a sufficient height above it is a squared scanting of timber so adjusted that it just fits its own edges against the shear edges of the trough, forming as it were two pairs of shears, one on either side of the trough. The suspended log is released by means of a small catch or trigger in the bottom of the trough, the apparatus is in duplicate and is similar on both sides of the fence so as to provide for the pig on whichever side he happens to arrive.

He is forefended from entering the trough in the direction of its length by means of two hooped pieces of bamboo placed at its mouth on either side and is compelled to enter it obliquely, and in so doing he necessarily puts one foot into the trough before the other; that is enough, the merest touch it starts the catch, and down comes the log and breaks the leg.

Both deer and pigs are frequently shot, and every Kookee village has a few sportsmen, the proud possessors of guns, which they have purchased, or had given to them; these are generally old muskets, and the heavier and more substantial they are the better they meet with approval. A Kookee generally

looks for a piece that will not only last his own time, but has sufficient wear in it to be handed down to a succeeding generation, provided these qualities are ensured. He is absolutely indifferent to weight, and such improvements as sifting and, adjustable sights are lost on him who never wastes a shot on a distant object—who, unmindful of his own shoulder, imparts as much *vis viva* to the bullet as the barrel will bear. On moonlight nights when all nature is reposing in stillness, the bang of a Kookee gun is easily recognizable, and suggests reflections as to the amount of impact sustained, not only of the party in front, but also of him in rear of the projectile.

Pigs are shot by moonlight and after rain, on the borders of clearances and open wheel spaces, and deer in those grassy glades and "sunny spots of greenery" which abound in heavy ekur jungle, and are such a relief to the eye and feelings of him who has been hewing his way through the dense tangle: these are called "hurraias" and are a favorite resort of deer a little before sundown. There is also a mode of getting within shot of the barking deer whilst he is in heavy jungle, by making advances towards him quietly and cautiously under cover of the loud sounds he emits, which make the minor sounds, a man makes in getting through the jungle inaudible. The deer may be approached within a very short distance: this is also, be it observed, the method used in approaching the hoolook or long-armed black ape, and any other is almost certain to be unsuccessful.

Although the tiger cannot be classed under the head of game slaughtered for the sustenance of man, still his destruction is an event celebrated in a Kookee village with such rejoicing and feasting, that the sort of trap by which his destruction is accomplished deserves a word of notice. Hearing that my jhoom Kookees had set one some way up the cherra above the jhoom, I took occasion one day, when I happened not to be very far off from it, to go and inspect it, and was much struck with its ingenuity and the way in which it was constructed entirely of materials, all of which were close at hand.

The point where it was set was a crossing, where the tiger who used to promenade the khal for considerable distances, was in the habit of leaving the stream and ascending the bank; here a sort of deep cut got worn in the bank, resembling that made by cattle where they cross a stream. It was here, not immediately on the margin but a little way in, that the trap was set; his path not naturally very wide, was still further restricted by brushwood and stakes so as to constrain him to take a given direction. The trap consisted of a powerful catapult made out of a *Nayessor* sapling, the butt end was placed between two other trees and then drawn back as far as its elasticity would permit by the united strength of a couple of men; the tip of

the catapult was fastened to the base of the dart which was also drawn back to its fullest; the dart consisted of a choicely selected and very straight bamboo, which rested in the forks of two boughs planted in the ground so as to ensure the dart working backward and forward quite straight and without deviation, canopies were lashed over the forks to prevent motion in a direction up and down: thus when the catapult was released the dart shot forward with great force, and in a direction that could be calculated to a fraction of an inch.

It now only remained to fasten on the head of the dart, which consisted of a piece of a particular sort of jungle bamboo very hard and with a good silicious coating: a piece of this was split and pared off until it was reduced to the form of a dagger about a foot in length with a fringe or edging of silica of a keenness like that of a broken bottle. The entire weapon seemed calculated to answer its purpose quite as well as one of steel, and in one respect was considered by the Kookees to be superior, inasmuch as the tiger was sensible of the scent of iron, and was thus deterred from approaching it. The height at which the dart is fixed is calculated with great nicety from the foot-prints of the tiger, and the catapult is released by means of a small catch which in its turn is attached to a filament of a sort of climber that grows in the jungle and is about the thickness of an ordinary piece of twine; this is stretched tense across the path.

The tiger, whilst advancing, bears against the creeper with his breast and seldom fails to be transfixd through the heart, and is found dead within no long distance off the spot.

The Kookees are, from the necessities of their position, no great subsisters on fish, what they do consume is not as fish, but in another form presently to be mentioned. They are far from possessing all the varied and ingenious contrivances in use among the people of the plains, and are content with a few simple fish-traps. One is the "bawm" or "koko," or if of a larger size it is called "kok." It consists of a bamboo cylinder with an opening for the fish to enter, but so arranged that they cannot with equal facility go the reverse way; the trap is baited with earth-worms.

There is also a long tapering cone of wicker-work which is set in a dam or bund and the fish swim upon them, and when they reach the narrow end are debarred from turning round.

There are also contrivances similar to those in vogue among the people of the plains for catching fish by means of enclosures and baskets formed of split bamboo and filled with brushwood, which by its shade invites the fish to repose amongst it.

Another mode of capturing fish is by poisoning or rather intoxicating them, with which object parties are made up at the bothy who takes provisions, &c., for some days stay. A section

of the khal where the fish are most plentiful is dammed, and the pulped root bark of a sort of climber is infused into the pools where the fish are most plentiful, they soon feel its influence and turning up their bellies float to the surface. The party return with their baskets well filled with fish, which are for the most part converted into the condiment called "heedol," this is a relish and digestive that is much used with rice; it is made by ramming the fish into a bamboo joined together with salt and other flavouring substances. Here it undergoes partial putrefaction, and is then ready for use.

During the months,* tool-bool, vat-chang and thla-kaow to wit January, February, and March, the Kookees had cleared a large area perhaps as much as three hundred acres; and this without any very steady application, giving themselves frequent holidays and not unseldom indulging in hunting and fishing excursions.

The jungle having been cleared it had next to dry, and for this it had ample time allowed it. The burning was deferred as long as possible, the weather being carefully watched. The thunderstorms of March and April they did not mind, as they did not wet the jungle so much, but that it dried again soon after, and thereafter still kept on getting drier and drier.

Some years differ from others in the quantity and earliness of the rain, but the particular year I am referring to happened to be a dry one, and they were able to defer the burning to the middle of May. It was not till then that rain came which was heavy enough to soak the ground to some depth and to collect in all the low places, and had the burning been put off to a still later date the consequences would have been disastrous.

In an earlier burning much of the jungle would still have consumed perfectly, *viz.*, the bamboos and other light stuff which dries rapidly; but the branches and boughs of trees which take a longer time to dry would have been left unburnt and had to be chopped up and carried off at a great expense of labour.

A well-burnt jhoom should show scarcely any thing but ashes varying from ankle deep to a mere sprinkling, where bamboos† have been pretty thick, they have a very thick but loose covering of filamentous ash.

* The Kookees reckon time by the lunar month. The names of the months being as follows, and counting from new moon to new moon, the English months to which they correspond being given opposite—

January ..	..	Toolbool.	June ..	..	Thladou.
February ..	..	Vat-chang.	July ..	..	Thla-moorr.
March ..	..	Thla-tai or Thla-kaow.	August ..	..	Thla-jung.
April ..	..	Thla-toon.	September ..	..	Thla-ram.
May ..	..	Thla-phool.	October ..	..	Erthla.
		December..	November ..	..	Thla-phal.
			December ..	..	Birip.

† The vicinity of bamboo clumps may generally be seen after a jhoom fire to be strewn with pieces of white chalk like tabashoeer, which lying on the dark ashes are very conspicuous. This substance seems to be there out of the drying of the water that exists on the lower joints of all green bamboos.

There are some sorts of vegetation, however, which, owing to the large quantity of moisture they contain or the difficulty with which they part with it, generally remain unconsumed, and although externally scorched and blackened yet manage to resist the fire: such are the generality of climbers, especially such as are thick. The palms, palmyra, betel, and others are also with difficulty consumed, as also the trunks and boughs of the larger trees.

In the burning of the particular jhoom I am referring to, the Kookes deferred the firing as long as they could, but perceiving at length that heavy rain was not far off and that a little too much delay would undo all that for which they had been waiting so long, they came to the conclusion of awaiting the first favourable day, a hot sunny one with strong gusts of wind. They were careful not to fire too early in the day but gave plenty of time for the sun to dissipate up the dews and condensed moisture of night, in fact it was past mid-day before the fire was applied. This was not at a single point; but several in order to finish the job as quickly as possible lest night should come on with its heavy dews and damp to put out the fire.

The conflagration went off with a roar and a smoke, equal, for the time it lasted, to that of a great battle. By 2 p. m. it was all over, and at sunset there was no indication of any such energies having been in play except a peaceful looking blue filmy cloud of smoke that descended and reposed over the scenes.

On going over the clearance the next day it was quite cool, and there was no fire anywhere except where stumps and prostrate trunks of half decayed trees had taken fire and were consuming slowly like exaggerated cheroots leaving a trail of white ash. Wherever there was timber and brushwood it had also burnt off quite white, bamboo tracts were of a greyish tint.

The heat of a jhoora fire does not penetrate the earth to any great depth, nor does it kill the seeds of such vegetation as the earth contains, except such as lie at the very surface.

Where, however, bamboos have lain thickly such is the fierceness of the flames that the surface soil is burnt black, and in some places to a brick red colour. In these particular spots no weeds at all come up, the land remaining clean throughout the season.

Virgin forest, such as this jhom consisted of, is always considered the very best sort of land as well for the superior richness of the soil, as because it has very little disposition to foul, and the weeds which do come up are such as can easily be rooted up and are not grasses which cost an infinity of trouble. In this our jhoom there was no grass anywhere except a narrow strip on the west side of the khal where cattle had been in

the habit of passing and repassing ; this part had to be weeded once or twice.

There were also places which had not had a strong fire over them which had a greater tendency to foulness, and which had also to be gone over more than once ; but speaking generally the entire season's cultivation was achieved without any weeding at all. Of such excellent quality was the soil and so well timed the operation of firing.

The very next day the men were all over the land besmirched and smeared with ashes and begrimed and blackened with coming in contact with charred twigs, each with his "too," a sort of instrument somewhat like a small adze for sowing Indian corn and dhan. The seed is contained in a cloth or a small basket at the side, and whilst one hand was occupied in chopping holes in the soil, the other was equally engaged in dropping into each a few grains of Indian corn, shutting them in with his heel. In this fashion all the Indian corn was first sown, the dhan sowing being held in reserve until after rain. As it happened the supply of seed possessed by the village was insufficient to cover the whole of the land cleared, and only a portion of the jhoom could be gone over with it.

Some of the hands were engaged in clearing up, that is, getting together all the rubbish, creepers, bamboos, &c., that had escaped the fire, chopping them in pieces, and throwing them into fires, made every one here and there as was convenient. The corn could be sown with the rubbish still on the ground as the holes for it were wide apart and branches and boughs did not interfere to the extent they did with dhan which was sown much closer together, and which therefore required the land to be cleared first.

Heavy rain came a few days after the firing and washed the ashes into the soil, from which there arose the peculiar Guansey odour given out by newly-cleared soil when wet by rain. The khal from being a mere dribble swelled to considerable dimensions and swept along clashing at the obstacles it had to contend against in the shape of innumerable trees felled into it, as well as sundry rafts of rubbish for which it was considered a convenient receptacle.

The land having been cleared by the united labour of all hands, the next step was its allotment to the various members of the village. This allotment was made according to houses and boundaries, natural or artificial, were assigned within which each house or group of houses cultivate and appropriate the produce so raised.

For the sake of illustration I shall give the allotment of one of the jhoom sections with the names of the parties, which will enable the reader to infer how the rest was disposed of on the principle of *ex uno disce omnes*.

Notes on the Kookee Jhoom Cultivation.

The entire jhoom was divided into two sections—a north and a south. The demarcation between them was natural, and consisted of rills (tributaries of the Jalingacherra) along the course of which a fringe of jungle was left uncleared.

Immediately after the burning and before the sowings took place a road was demarcated continuously along the length of both jhooms so as to connect them with each other, and hence also there being already a path from the north jhoom to the village. With the village itself the road was indicated by upright trunks of wild betel-palms (Kookee, that thing) laid* along continuously: this mark enabled the sowers to avoid the high road and thus obviate waste of seed.

Referring to my note-book I find the north jhoom distributed as follows where the boundary was not natural, such as a khal or a rivulet it was indicated by "that things" stuck in, the Kakbra khal was a small stream that cut across this jhoom. East of this khal belongs to Thoma Hling-chong, Hling-nay, one house, west of khal; Chengtay (W.), Taitil-vanni (W.), Chengtay (W.), Chengtaynoo, one house, south of White Ant-hill Rooipa Muntri, Booma; Choonga Lall-poo (W.), and Hooindoo-noo (W.), one house.

It is not necessary to particularize names any further, suffice it to say that the entire jhoom was similarly divided, each house had its own lodge in the jhoom. These lodges were all made on much the same plan and consisted of both dwelling-house and store-room all in one; the store-room constituted about one-half, which was occupied by a sort of bin made; all four sides and bottom as well of bamboo turza. Access to the interior of this bin was by a small window opening into it from the dwelling-house: this window could be securely closed against intruders, such as rats and squirrels.

The rest of the house constituted the sleeping, cooking, and eating apartment all in one. It was simply furnished, a mud hearth (tap koo-oong) with stone props for putting the pot on in cooking. A small bamboo shelf for pots (gáp-leng), an open trellis of bamboo above for clothes and sundries that require to be put out of the way. A sort of bamboo pocket (jil-vang) for holding spoons. The moveables were chiefly such articles as drinking gourds (aghwa), pots, bamboo-chongas, and pillows.

Of these lodges there were eight in the south jhoom, and whilst they were in the course of building, the bothy still continued to be the general abode; but as they progressed towards completion, it was itself pulled down to afford materials for the others, and more particularly thatching.

One especial reason why the bothy could not (now that the rains had set in) continue to be the general abode, was to be found in the fact that it was built on the ground, and although

well enough for a cold weather residence, would inevitably become damp and unhealthy as the rains advanced. There is nothing that Kookees and indeed all hill-men in these jungles are more particular about than living at as high an elevation off the ground as possible. They consider this a most necessary preservative against sickness, and such elevation besides contributing to healthiness and avoiding dampness, also affords some degree of immunity from mosquitoes and greater coolness and airiness than could be had on the ground.

This plan of building may be observed in the houses of their villages as well as those of their jhooms, the posts on which the latter are built, are not very stout and heavy, but on the contrary the builders prefer them rather light so as not to be too great a load, and make up by setting up an extra number. This stability is greatly added to by shears or "kynchees" placed on both sides of the house, and bound together in pairs at the ridge pole, and also props placed against the posts, especially on the opposite side to that whence the prevalent storms come.

Although they are very particular about putting a very close double turza round the granary, they do not care about close walls in the dwelling part of the lodge. If they put anything it is a light single turza which admits air freely, nor do they ever plaster their dwellings with earth or cow-dung.

The sides are sometimes made shiftable so that they can be let down or swung out of the way, leaving the house quite open; the eaves are, however, always brought low down.

Turza, which plays such a conspicuous part in the building operations of the Kookees, consists of nothing more nor less than a very strong matting made out of jungle bamboo. It has considerable stiffness, and for walls and partitions requires no support, but moderately supported beneath by means of whole bamboos; it also affords a firm and somewhat elastic flooring and is then an excellent substitute for boarding. Turza is made by breaking the bamboo at the joints by heavy blows with a club on a block; a *dhau* is then run along, and it then admits of being opened out flat, in pieces of the length of the bamboo and about six inches wide. This bamboo tape, for such it has in reality become, may be woven by laying the warp along the ground. A sufficient number of men then separate and hold up the alternates, and the weft consisting of precisely similar pieces of bamboo tape is then inserted precisely as in weaving, and driven home by the men striking simultaneously with a mallet: this is what constitutes a double turza and is used for platforms, sides of bins, covering of bridges, and the like. This sort of turza is necessarily uneven; but where a level surface is an object as in *machans* for sleeping on or a less substantial texture is no drawback, as in the walls of houses, the single turza is the sort used. This is made by laying the tapes as before, but instead of weaving into them other

Notes on the Kookes Jhoom Cultivation.

tapes, simple narrow strips or laths of bamboo are used whereby a more uniform matting is obtained. If intended for sleeping on, the joints of the bamboo are pared off with the *dhan* after it is split.

In some jhoom granaries it is found preferable to make the turza grain bins circular instead of square; this is managed by making the turza all in one sheet and bending it round into the cylindrical form, so that it shall have no joints except at the overlap. As the land was cleared of the rubbish, the *dhan* was sown in much the same way as the corn, that is to say, with the "too." A good deal of seed was put into each hole so as to provide against the depredations of birds, which were sufficiently numerous to cause considerable vacancies. Had this precaution been neglected on the other hand, there being several plants instead of one to each clump was no detriment, as the clumps filled out and were as productive as if there was only one plant to each. Moreover, in many places, the extra plants of the clump answered as a nursery reserve to fill in the low-lying patches of puddley land. These patches were omitted when the land was gone over with the "too," and left to be filled in subsequently by transplantation.

In the present year's operations the Kookes as I have said made no special nurseries for filling in the morasses, but in other jhooms where they formed a larger proportion than usual of the whole, I have seen nurseries made for the purpose since the supply of plants derivable from the clumps would have been insufficient. The nurseries were simply sown on hill-land on the open porous soil, and then trodden in without either digging or turning the soil into muck in the fashion of the people of the plains.

It was not until well on in the moontheadon (June) when the *dhan* was well advanced all over the jhoom, that I saw the men at work transplanting; they were doing this very leisurely and with nothing like the quickness and adroitness of the Bengali. In answer to my enquiries as to why they did not get on faster, they said that they had to be careful of thorns (chiefly cane) which lay concealed under the surface of the mud and made it necessary for them to dibble in the plants somewhat carefully. To obtain the plants the clumps in the immediate vicinity were taxed about one-half, the entire clump was pulled up, the rest being left. The portion detached was then struck on the hand or knee several times, which had the effect of separating the plants, the roots of which growing as they are in close proximity have their roots entangled.

Going over the jhoom on the 25th June I took note of the progress the different plants had made in growth. The Indian corn was three feet in height, the yams had attained a couple of feet, and that string poles had been planted for them to

climb on. The dhan was three inches high, a pumpkin (K Changma) had made 12 leaves; Capsicums (murcha) 1 foot; Solanum) Begoon or K Panchaw) 3 inches; bean (K Bething) 1 foot; for this also poles had been placed for it to climb up. The Sesamum (B Til K. Shi) had made 5 leaves; the Solanum plants had been put out from nurseries made in the shade of trees; the Kochoo Yam (bál) which, as well as the Convolvulus Yam, was planted from cuttings, had made three leaves.

The weeds had made very little progress and were already almost covered by the dhan, none of them had acquired a sufficient size to make it imperative to root them up except the bamboo, which, as it had all the vitality of the live stools remaining in the ground to draw upon, sprung up with great force and quickness and had to be cut over a couple or three times.

The weeds consisted of convolvuluses—Goodee, a sort of malva k-booi-ner, convolvulus, k-par-nem, wild turmeric, k-na-thil, wild fern, k-chek-aw. Another plant the Kookees call belkan cane, tai-pha, a fan-palm, rai-sha-na, and other plants, the name of which I was ignorant of, but the Kookees called kha-give, api-shoo-mool, chan-kawlian, khao-shun, rail-king.

There were also the bontipari, tompoo, junilot, vaashit, a sort of cinchona-gál, sum-kooi, acacia, jai jow, and a palmaceous grass aichoon. The Indian corn was finest of that anywhere else in the entire clearing on a small patch of well-elevated sandy soil adjoining the khal in the south division, belonging to Batsong's house which consisted of himself, his mother, wife, and a couple of children. This patch of corn consisting of a couple of acres was truly a fine sight for its great size and splendid luxuriance.

Towards the end of July the dhan was up to the knee in favorable places; laoo and kurrella had spread considerably. Sesamum plants well filled out, of these the lower branches were broken off as the dhan would interfere with them. The plants thus attained to a greater height than they would otherwise have done.

The "chicha" or dye plant which may be called the Kookee indigo was sown on a tillah by itself, as if sown amongst the dhan the two would interfere with each other, the dhan causing the leaves of the dye plant to ripen and fall off.

In a subsequent paper I shall continue to describe the processes of Jhoom cultivation, giving some account of the feasts, festivals, and harvest.

NOTICE OF A PECULIAR PINE-APPLE FROM MYMENSING.

I ENCLOSE you a very hasty sketch of a most peculiar Pine-apple. It was grown somewhere in these parts and brought in a *dallee* to our Collector who gave it to me. I was inclined to think it was a *lusus naturae*, in vegetable life, but he said he thought *not*, and subsequent enquiry seems to confirm this. We hear that one year seventeen were brought from the same place, and another year twelve, and I have been promised a plant of this peculiar pine-bearing species. I have not exaggerated one whit, the centre pine was much over a foot long, tapering downwards and terminating in what looked like three fingers. These were nothing but the pine itself extending a little way (the upper and thicker part of the fingers so to speak), the thinner part being embryo leaves terminating in a little tuft. From the top *seven* smaller pines projected, each terminated by a tuft of leaves. I would have sent you this had it been possible; but as I feel sure you would be glad to hear of it, I have described it as well as I could. I must tell you that it possessed the full scent of the pine, and when one of the smaller ones broke the juice literally ran from it. Have you ever heard of such a species? Pines are so common in the surrounding districts that they are used for making hedges. We are going to plant all the tufts from off the little pines, or shall I call them pinelets? We hang it up by the stalk, hence my describing the stalk end as the top.

Note by Mr. John Scott.—I have occasionally seen fruits of the pine-apple very similar to that of which you send me the sketch and description from your correspondent. The *sorosis* form of fruit (as represented by the pine-apple, the bread-fruit and mulberry) consists, as you know, of a shortened spike or raceme in which the tracts and floral envelopes are more or less succulent, united, and converted into a fleshy fruit. Now, as in the case above referred to, some varieties have a

tendency to become proliferous, and the individual flowers form separate and independent fruits. I may remind you of the Chinese variety, known as the many-headed pine, in which the individual flowers are all converted into miniature, but perfect fruits, each, as well as the central axis, bearing a terminal, leaf shoot.

Your correspondent's variety differs considerably from this, as would appear from the sketch and description. It would be well worth adding to your collection.

Curious Horticultural circumstance ; Communicated by

COL. LOWTHER.

FOR some years past I have been endeavouring to hybridize that beautiful *Convolvulus*, *Ipomæa rubro cærulea*, (the true blue) with its white variety. I obtained the seeds of the latter while I was at Jubbulpore and have for several seasons sown the two mixed together, without any results in variegation, or the origination of any variation: this cold season, to my astonishment, the produce of these repeatedly associated colours, has ended in the whole of my stock being *pure white*! The plants are very vigorous, and are growing in all aspects, sunny and shady, and in the same rich quality of soil. The flowers are full sized and are frequently mistaken by strangers for the "Moonflower" (*Ipomæa grandiflora*).

Is there any recognized law of "Vegetable Physiology" which can shew a tendency to the "Albino Type"?

Note by Mr. John Scott.—With reference to the results of Col. Lowther's experiments in the annual mongrelizing of the white and blue flowered varieties of *Ipomæa rubro cærulea*, I am not at all surprised. Both in the animal and vegetable kingdom it is well known that albinism is strongly inherited. In treating of inheritance in plants, Mr. Darwin observes, that "it is a singular circumstance that white varieties generally transmit their colour much more truly than other varieties. This fact probably stands in close relation with one observed

by Verlot, namely, that flowers which are normally white rarely vary into any other colour." "I have found," continues Mr. Darwin, "that the white varieties of the *Larkspur* and the *Stock* are the truest. It is, indeed, sufficient to look through a nurseryman's seed-list, to see the large number of white varieties that can be propagated by seed."

These remarks of Mr. Darwin's have however mainly relation to natural variations, while Colonel Lowther's case is a result of mongrelism. Now in this as in hybridism there is nearly in every instance a strong tendency evinced in the successive progeny of such unions to revert to one or other parent, so the *Ipomœa rubro cœrulea* case goes to shew that as in the inheritance of natural albinism, so in that of mongrelism the albino form is the more strongly inheritable. As an analogous case, I may observe that *Ipomœa purpurea*, which has given rise to varieties varying from blue to dark-purple crimson and white, there is a great tendency; when grown together for successive seasons, in the white variety to predominate, and indeed alternately displace all the others. On the other hand there is no difficulty in keeping up the several varieties when grown separately, so that the former result is no doubt largely attributable to intercrossing by insects.

THE GARDENER'S NOTE BOOK, No. 21.

Chillies and Capsicums ; By COL. W. H. LOWTHER.

STRANGE that the baneful order of *Solanaceæ* should contain some brilliant exceptions to the rule ! All the family of *Capsicums* supply pungent and useful condiments, not only relishing to the palate but assisting digestion, and in moderate quantities helping the stomach to transform the mass of vegetable foods into nutritive matter. In all hot climates man seems to have an inherent longing for these peptic stimulants : the white and black man alike have gree-

dily added them to their dieting ingredients, and thus the culture of such plants, under varied conditions of soil and climate, has largely added new forms of the pod to the original stock. The number of hybrids at the present time seems largely distributed—all diverse in shape, flavour and percentage of acrid oil. I will specify a few of those which are most generally cultivated.

The "Bird Chilli" (*Dhán Mirich*) of the jungles, and found in native gardens, is the *most fiery*, though the smallest fruited of the whole; this is *Capsicum minimum*, and owes its primary birth, *it is said*, to seeds of the longer kinds of Red Pepper, passed through the stomachs of birds; but whence the proof?

I saw these diminutive pods used to "spice" the vinegar, in South Africa, but from their burning and inflammatory character (the juice containing a *maximum* proportion of *Capsicin*), I think them fitter for the Apothecary's than the Grocer's preparations. A favourite joke with the native "paungles" used to be the offer of a rupee, made in a bet, to any individual who should eat *one, and only one*! I never saw a man who ever succeeded in accomplishing the feat! I remember finding one of these pretty little shrubs in a jungle, covered with its numerous crimson fruit, which I thoughtlessly gathered for use. Soon my right hand and arm were in such a *rubefacient* condition that to alleviate my torments and obtain a night's sleep, I had to place the inflamed member in a large basin of water put on a chair at the bedside! I have met with "Cayenne Pepper" in Europe that must have been prepared from this kind, *through ignorance*, for it excoriated the tongue and lips!

"Great Bullock's Heart." This is occasionally met with of some size in India, but very far inferior in flavour and proportions to those of Gibraltar, where it attains about a quarter pound weight and is a favourite vegetable, possessing the full

- Flavour of a "chilli" without its pungency. The pods are sliced into shreds and stewed with large tomatoes, onions, black pepper and salt, with butter and gravy: there is no better dish in the world! Seeds brought from the "rock" grew into fine plants at Jubbulpore and Benares, but they bore sparingly and the crop was small sized: shrivelled leaves often preceded the decay of the root; (as so common in tomatoes.) A smaller variety of this pod, much better to the palate, comes from the West Indies, and will be found in pickles from those parts. The "Cherry Chilli" of a copper colour, when unripe, is common now-a-days in our Indian gardens and seems to have been introduced; this is a very prolific plant and rather fiery in taste, it is sometimes seen with taper pods, sharp pointed. A slender yellow fruited kind, bearing abundantly and moderately hot, is very common in village gardens.

The "large Long Pod" (*Burra Lal Mirich*) is the usual produce of the market gardens throughout India, and stands next in point of acrid strength to the diminutive "Bird Chilli." Thousands and thousands of tons are annually consumed in the "Sunny East." From the prince to the pauper of dark complexion, men in many lands and many islands compose the millions of daily consumers. Southern Europe, too, eats its share of the stimulant, while the colonists and exiles from the north seem to acquire a taste for its biting savour when they leave the realms of ice and snow for fervent latitudes—some natural craving prompting this consumption of the pod!

- Last and best of all comes the "Nepaul Chilli," that too little known pod of delicate aroma and strawberry-like flavour, of which the Cayenne powder is exquisite. The plant, as might be expected, is rather hardy; with common care it grows well in Europe, and bears its orange hued capsules plentifully: at Port Natal too it is acclimatized. I gave a packet of seed to a zealous tradesman there, and in

two or three years afterwards he wrote to me that he had manufactured *more than a ton of Cayenne*, and was increasing his business in that article! About a year and-a-half ago an old Military Pensioner brought me down a *pillow case* stuffed with this nice chilli, grown by himself at Khataman-doo, and of which I have distributed some pounds in England and elsewhere. Like all who have ever tasted this kind of cayenne, I never use any other; it is not *fiery*, which is a great recommendation. Nearly forty years ago the Nepaulese traders were said to *bake* the pods, with the object of preventing the propagation by seeds; out of many hundreds carefully sown I only raised a very few plants and fully believed the report. Now-a-days, in many favourable localities of Hindustan, the pod is produced, (as at Jubbulpore and elsewhere in hilly districts) I never met with it in the English market, and it is not generally known.

There is a strong inclination to "sport" and hybridize in the whole group of "peppers," as in other *Solanaceæ* the tobacco, potato, &c. &c.

Note on the cultivation of Prickly Comfrey, at the Government Botanical Gardens, Saharunpore and Chajooree, and in Kumaon. (Communicated by the Director, Department of Agriculture, N.-W. P. and Oudh.)

A CASE containing 30 roots was received on the 17th October 1877 from England, through the office of the Director of Agriculture and Commerce, N.-W. P. and Oudh.

Fifteen of these roots were selected for planting at Saharunpore, and the rest were sent to the Chajooree Garden on the Himalayas.

At Saharunpore a small piece of ground was carefully prepared in a shady part of the garden, where the soil was best suited for the cultivation of this plant.

The roots, before being divided, were placed in the ground for a few days in order to induce the formation of new leaves and roots. On the 15th November they were taken up and cut into small equal portions and planted in pits three feet apart and manured with some good rich leaf mould.

The plants made very little growth until the commencement of the warm weather. By the month of May they had attained a height of about three feet only, but the plants looked healthy enough.

On the 31st of May a few of them shewed signs of flowering and twelve of the plants were cut, and the leaves given to some of the garden bullocks and were greedily devoured by them. One week after this another twelve plants were cut, and on each day from the 5th to the 10th of July the leaves from twelve plants were taken.

A second crop was cut from the 13th to the 17th of July, but the produce was small.

The plants after this became sickly; they were lifted on the 14th of August, and the roots kept in sand for replanting.

At Chajoorree Garden the experiment has proved more successful. Three crops have been taken, and the plants on the 12th of this month were looking healthy and nearly fit for cutting a fourth time.

I do not believe that the conditions at Saharunpore as regards either climate or soil are favourable for the profitable cultivation of this plant.

The results of the experiment at Chajoorree however are so far successful as to favor another trial during the coming season.

DATED BOT. GARDEN,
SAHARUNPORE,
The 18th October, 1878. }

(Sd.) J. F. DUTHIE,
Supdt., Gort. Bot. Gardens,
N.-W. Provinces.

WITH reference to your No. 861 T of the 24th Instant I have the honor to inform you that early in 1877 I procur'd a box of Prickly Comfrey roots from England; out of the whole box but 12 roots were alive. These I had planted out half in a shady corner of the municipal garden, and the other half in a box. All the roots thrive well. Those in the garden stood the frost and cold remarkably well, and I subsequently transplanted those in the boxes to the same place. The whole stood the frost of last cold season, and this year have sprouted to at least $2\frac{1}{2}$ feet in height, and flowered.

I have had them cropped three times, and the municipal ponies have been fed on the leaves which they eat greedily. During last rains I have had the roots divided and transplanted, and by next year these ought to be enough to cover more than double the space now occupied, and I have no doubt of the plant thriving, and feel sure it will answer for fodder also. I propose trying it in other situations where water is not, as far as we know, near the surface; as where it now is there is water within about eight feet of the surface.

NAINI TAL,	}	(Sd.) C. J. GARSTIN,
28th October, 1878.		Asst. Commissioner, Kumaon.

INFORMATION has since been received from the Superintendent, Saharunpore Gardens, that cuttings were made on the 7th August, 11th September, and 15th October with an average of 30lbs. each. The fifteen plants had been manured with cowdung and planted at three feet apart.

The above data give 135 square feet to fifteen plants with three cuttings of 90lbs, or about 40 maunds (of 80lbs.) per acre in the three months. It is desirable to obtain more statistics.

- (1.) As to possible number of cuttings per year.
- (2.) As to nourishment afforded by the fodder.
- (3.) As to weight per cutting on a given area.

These statistics will be obtained during the forthcoming year.

New mode of multiplying Plants.

The general result of the experiment in this Department is that the climate of the plains is quite unsuitable to the Prickly Comfrey, the plant having failed wherever it has been tried; but there is still some chance of its succeeding under proper treatment in the Hills.

(Sd.) E. BUCK,

Director, Dept Agri. & Commerce,
N.-W. P. and Oudh.

The Gardener's Note Book, No. 22. New mode of multiplying Plants; By T. M. FRANCIS, Esq.

WITH reference to my letter, (see Gardener's Note Book, No. 20) describing the American process of striking cuttings of hard-wooded plants by burying them upside down, I have now the pleasure to report on an experiment which I have made.

On the 18th December 1878 I buried 20 bundles of cuttings, taken from the prunings of my rose trees. The roses so treated were (*inter alia*) Alba Rosa, Beauty of Waltham, Deuil de Prince Albert, General Jacqueminot, John Hopper, Jaune d'Or, La France, Marechal Niel, M. Ravil, Mme. Charles Verdier, Mme. Laffay, Murrillo, Prince Camille de Rohan, Reine des Violets, Solfaterre, and Souvenir de Wm. Wood. I only put down a few cuttings of Marechal Niel and Solfaterre, as I was doubtful whether they would succeed.

On the 5th February 1879 I disinterred the cuttings by turning the box which contained them upside down. (I must premise that the box had been left during the above period exposed to the sun, the earth being moderately watered every morning, and covered with a jhamp or mat every evening.) As each bundle of cuttings was taken out, I put

its lower end into a pail of water in which the cuttings were carried to a spare bit of land which I had previously enriched with *koonee*, i. e. well rotted indigo refuse. Here the cuttings were sorted and planted out at intervals of six inches. Those which were dead, or had failed to form a callus, were put aside in a basket. When the planting out was finished, all the cuttings were carefully counted. The result is as follows:—

Cuttings originally buried	...	...	437
Failures...	...	...	107
Callus formed on	...	...	330

This may, I think, be regarded as a success, and the results would have been still better; but for a tame mongoose of mine which scratched away the earth from the cuttings on three several occasions, thus exposing the lower ends, which were of course uppermost.

Every callus was well formed, and in most cases the leaf-buds were well developed and ready to start. In some cases they had actually started, and were pushing towards the light, so that they were obliged to reverse their natural growth.

In many cases I found that a callus had formed at *each* end of the cutting. I selected six of these for a further experiment and cut them in halves, planting the lower ends in the plot of ground which I had prepared, and putting the upper ends into flower-pots with good soil. I will let you know the result of this experiment. If it succeeds, I can claim the credit of raising plants from cuttings *planted* upside down. I shall be glad to know if this has been done before. My horticultural library is limited, but I cannot find in it any account of this reversal of the laws of nature having proved successful in its results. The six cuttings, thus treated, are of course distinct from the 330 on which a callus had formed, and if they take, I may claim a further success.

Henceforth I shall always use the American process for hard-wooded cuttings, and I trust that my success will induce many other Members of the Society to give this process a trial.

About half the cuttings of Marechal Niel and Solfaterre succeeded well. I rejected *all* doubtful cuttings in order to give a fair report.

THE GARDENER'S NOTE BOOK, No. 23.

A few further observations on aspect, with regard to the growth of Plants ; By COL. W. H. LOWTHER.

As I said in a former number of your Journal, light and heat are the controlling influences of all vegetation, the solar rays yield, or deprive of colour and quality ! Here is a curious instance in proof of my assertion.

I have two hanging baskets of cork suspended in my verandah, I will call them No. 1 and No. 2. Early in the cold season I planted a healthy carrot in each, with fully developed foliage, appearing like the fronds of a delicate fern, for which in this dry climate it supplies a good substitute. The distance between these pendant receptacles is only five paces. No. 1 is just clear of a pillar, and gets the rising sun for a short period varying with the season. No. 2 receives the direct rays for some hours, its aspect being more south than east.

For about six weeks No. 1 was the most striking, in the full beauty of gracefully pendulous foliage, its numerous decom-pound leaves vivid green and more fern-like than ever, while No. 2 slowly and steadily restricted itself to the sparse and normal growth of the true esculent, and so it remains ; while its first named neighbour has suddenly transformed itself from the *trailing* to the *climbing* type, a centre stem of

with regard to the growth of Plants.

four feet long has twisted and turned upwards, along the wire suspender, with a flower at the apex, where it has met the ceiling !

In the primitive jungles where giant vegetation has choked the undergrowth and darkened the shade of indigenous flowers, many such similar occurrences will be noted by the lover of nature. Albino foliage and inflorescence added to changes of habit, armed plants losing their spines, &c. &c. The gorgeous blue *Thunbergia grandiflora* of the Assam forests will be often found *snow-white*, in the dark, tangled brakes, while in the "orchid" tribes the reverse operation *too much light*, (accidentally caused by storms, floods or natural decay of trees) renders the gorgeous *Vandas*, *Aerides* and *Dendrobiums* dwarfish and pallid in hue ! Thus in horticulture we must study the exact measure of solar light on which the normal type of floral beauty depends, and this is only to be acquired by perusal of Nature's great book !

"High cultivation" means attention to the above laws of light and heat, supplemented by a concentrated supply of suitable plant food, under which fixed conditions, size, beauty, odour, flavour, hue, and desirability may all be improved and even changed !

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OF

INDIA.

Notes on the production of Sugar in the Benares Division, showing the wasteful system now used, and the loss sustained, as indicated by the estimated out-turn of the Ghazee pore District. BY P. MICHA, Esq.

THE production of sugar in the Benares Division, like all other industries essentially native and on which no European improvement has been grafted, remains, to this day, governed by the same system of agriculture and manufacture which has existed for ages. The natives have introduced no change whatever, and yet no other industry has been more thoroughly improved during the last 50 years than the sugar industry.

Bad system of production.

If the difference on a given area between the out-turn in sugar of the Benares districts and that of other foreign countries which cultivate the sugar-cane was already considerable at the beginning of this century, ~~it is~~ now out of all proportions. Since the propagation of European theories on the nutrition of plants, manures rich in animal matters, and phosphates, have been largely applied in all countries where the cane is planted. The old vertical mill of Gonzalez de Velera has been superseded by the more powerful horizontal mill; the scientific treatment of the cane-juice to prevent

its rapid changes, which all result in the destruction of the saccharine matter; the adoption of steam apparatus, which enables the manufacturer to cook his sugar at a low temperature (commencing with Howard's vacuum pan, and ending with Cail's "appareil à triple effet"); all these, to which must be added the use of the hydro-extractor, or centrifugal machine for the separation of syrup and sugar, have brought the sugar industry nearly to perfection, whilst these districts have remained stationary.

Though matters are bad enough in other parts of India which have a cane cultivation, still the Benares districts adapted by the nature of the soil and the climate to produce the best of sugar, are certainly ahead of other parts of the Empire in the waste of their system of production. This result can only be attributed to two causes: the particular sugar-mill in use, and the method of manufacturing concrete or agglomerated sugar (Beli) as it is now done!

In Bengal, for instance, vertical cylinder mills generally, horizontal cylinder mills sometimes, are used. Those are made of wood entirely, and though such rude machines necessarily leave a great portion of the richest juice in the cane trash, yet they have an immense advantage over the Benares stone-rollers, which, triturating the pieces of cane to a dry pulp, not only presses out a juice already acidified by the action of the air, but also extracts the gluten of the cane, a powerful agent in increasing the acidification of the juice. In Bengal again no concrete is made, the juice is evaporated in deeper pans, earthen pans generally, where the heat is not so great, so destructive, as in the shallow thin sheet iron pans of these districts. The evaporation is carried only to the consistency of a thick syrup, when the contents are taken to another earthen vessel to cool, agitated after cooling to

Inferiority of the sugar production in the Benares districts, compared with that of other parts of India.

Comparison with Bengal.

Notes on the production of Sugar.

cause crystallisation, and the syrup separated in the greatest part, by filtration through a hole at the bottom of the vessel. The grain of the sugar yielded is of a fair size, the colour light brown, and the smell agreeable. Here, on the contrary, the juice is boiled down to siccidity, in thin iron pans, very shallow, and where the amount of heat developed is considerable, and consequently very destructive, the contents are rolled into balls of concrete (or *Beli*) dark coloured, strong smelling, and showing the very small floury like grain which distinguishes the Benares sugars. It is probable that in Bengal, no more than in the North-West, any attempt at tempering the juice by the use of lime is ever made; but at any rate the Bengalis take care to filter their juice through cloth before they boil it, and when sugar of a superior quality is wanted, they use milk for the purpose of clarification; whilst no attempt of that sort is ever made here.

The greatest part of the sugar-cane juice extracted in these districts (probably $\frac{1}{2}$ of the whole) is first made into concrete; the remaining $\frac{1}{2}$ is manufactured into a sugar approaching the Bengal sugar described above, with this difference however, that the acidification being stronger as caused by the peculiarity of the mill, the waste is greater, a larger quantity of syrup is separated, and a smaller quantity of sugar obtained than in Bengal; again, the grain is finer owing to the want of care in the preparation. Nearly the whole of the "goor" produced in the Benares districts is manufactured into "chini," that peculiar mealy description of sugar, which no other producing country can envy, and which is not marketable out of India.

No more evident proof of the wastefulness of the system of manufacture exists than the returns of the conversion of "concrete," or "beli," into "chini."

Description of the sorts of sugars manufactured in the Benares districts.

Wastefulness of the system of manufacture.

Notes on the production of Sugar.

- 100 of agglomerated "goor" yield in average
- 25 froth dirt, impurities of all sorts.
- 45 "choa" or "chova," i. e., molasses consumed
in the country, amongst the poorer classes,
and partially used also for the distillation of
spirits.
- 30 "chini."

100 Total.

These figures show a waste of, at least, 50 per cent. in the results obtained!

The first amelioration should be in the introduction of
Introduction of new new mills, with vertical or horizontal
Mills necessary. rollers, these necessarily made of cast-
iron. The Beehea Mill, already well known in Shahabad, has
given very satisfactory results, and the price obtained in the
bazaars for "concrete" made from that mill is from 20 to 25
per cent. above the produce of the native stone koloo.

The entire adoption of these mills, however, will take time,
and to think of replacing all the old mills in the country,
within a comparatively short epoch, would be to count upon
an eventuality, which an ordinary knowledge of the Indian
habits of conservatism renders very problematical, even if the
foremost question of cost of the new mills and that of the non-
value of the "koloos" did not prevent its being entertained.

If the introduction of roller-mills is wanted, a thorough
change in the forms and nature of the
Required changes in the forms and nature of the evaporating pans. evaporating pans is not less necessary.

I have said how the thin sheet iron
pan now used is defective. It ought to be replaced by a
deeper pan, made of cast iron, for economy's sake, which
would not give the blazing heat obtained in the present pans;
then, instead of one pan, only two at least are needed;
one for the purpose of tempering and clarifying the juice, the
other for evaporating. The Bengal Iron Works Company, in

the district of Raneegunge, could probably turn out the sort of pan wanted at a price low enough to permit its rapid adoption in these districts.

But while the Beehea Mill, or any other roller-mill is being adopted in the country, and while a new form of pan is being introduced, which will take time, it is necessary, if desirable to put a stop (a check I should say) to the present waste, that the means at disposal, that is the stone-koloo and the sheet iron pan, be used in obtaining that check. The remedy at least can only be a palliative, and the results obtained very small, compared to those which better manufacturing plant would give; but the waste is so immense that any improvement, however small, can only be a benefit. I think, therefore, that efforts should be made to induce the cultivators (who are all also goor manufacturers) to accept changes in their system of manufacture, (such as carried on at present) which, if they do not stop the entire waste, can certainly prevent a great part of it.

To show where the fault lays, I shall first describe the present process of manufacture, and indicate afterwards the necessary changes.

The cutting of the canes commences about the 1st December in the dry lands, and about the 20th December in those lands that retain more humidity. It continues to the end of March.

It is evident that, at the beginning of the season, the canes have not reached a proper state of maturity; the juice is thin, and the quantity of concrete yielded is only ten seers in average per pan, whilst towards the end of January and in February it rises to twelve seers, and during the latter part of the season it goes up to fifteen seers per pan. The reasons which cause the cultivator to cut his canes before they are completely ripe, are:

Necessity to use the means at disposal, if immediate results are desirable.

Cutting of the crop.

Changes in the out-turn as the season advances.

Means of the production of Sugar.

1st.—The very limited power of his roller which, with full hours, will take from fifteen to twenty days to crush a beegah of cane.

2nd.—The inferior quality of the concrete produce towards the end of the season; for if $3\frac{1}{2}$ maunds of concrete or beli yields 1 maund of chini in the cold season, it requires 4 maunds of concrete to produce the same quantity of chini as soon as the heat of the atmosphere increases a loss of 14 to 15 per cent in the former results. It is easy to understand that, during the cold months, the acidification is less rapid, not so strong, hence the gain. There are also other reasons which induce the cultivator to cut his cane before it has attained full maturity: his penury, which drives him to make money of all he can, to pay pressing demands; also the fact that later in the season, canes are apt to dry in the field. The matter of his penury is unhappily one of those questions that cannot be solved by advice; but regarding the danger of the crop drying in the field, it has a remedy in a better system of agriculture, without touching on the subject of manure, which is not certainly what the best of "assamees" recommend. I must remark that the planting of a sugar-cane field in these districts is certainly opposed to the system of husbandry accepted in other countries; not only the quantity of cuttings put into the ground is a great deal in excess of the requirements, but the canes are never allowed to see the light, no current of air can pass through the field, and as a consequence the juice yielded is poor, remarkably so, compared to the produce of other countries. Can it be wondered afterwards that the canes have not the strength to resist the first signs of the hot season?

I have shewn that the difference in the out-turn of concrete between the beginning of the season, and the end, is fully 50 per cent. in favour of the latter, whilst the loss in its yield of chini is only 14 per cent. It would appear, therefore, that the cultivators would have still great

Notes on the production of Sugar.

advantage in waiting till his canes be quite ripe, if he had not to count on the very limited power of his mill; and this state of things will remain the same as long as the stone kolooos are used. I am myself of opinion that the yield of 14 per cent less of chini towards the end of the season, as estimated by the natives, is not high enough an estimate. Let the hot weather appear and the acidification in the very crude treatment described above is immense, and the loss in sugar in the same proportions. It is well known that, in some cases, it has been impossible to obtain crystals of sugar, the whole of the rucrose being converted into glucose. Repeated occurrences of this event at times, when very hot weather sets in, have been noted.

In all Colonial climates under the effect of heat, cane-juice runs rapidly into the acetous fermentation: "twenty minutes, in many cases, being sufficient to bring in this destructive change" (*Ure*).

In cutting the canes in small pieces of 1 to 1½ inch in size, to be able to introduce them in their triturating mill, the natives necessarily expose all these sections to the effect of the air, and the chopped canes

often remain so exposed for hours before they are used. In the evening, for instance, canes are chopped into bits for the loading of the early morning, and remain in a heap during the whole night, the acetous fermentation going on all the time; then it takes from three to four hours to press enough juice to fill the earthen pan below the "koloo." This pan is broad open, and the fermentation already commenced on the juice, which adheres to the sections of the pieces of cane, is accelerated by the presence of the gluten, which the triturating "koloo" extracts, and prolonged during these three or four hours, so that when the contents are discharged into the iron pan a great part of the saccharine matter has been effectually

Notes on the production of Sugar.

destroyed. No attempt whatever is made at tempering, filtering, or clarifying. A strong fire is set agoing, and only the thickest scum is removed from the pan. I have said above how the whole contents of the pan, after having been brought nearly to a point of siccity, are agglomerated into balls, and this forms the "concrete" or "beli" so much in favor in the country !

Though the form of concrete is certainly the most difficult

The form of concrete to be retained in the improvements proposed on account of the demand by "chini" manufacturers for that particular form.

form of coarse sugars to manufacture properly: (I know only of the "concretor," made by Menlore and Allior of Nottingham, which turns out good concrete, and it costs £1,200 in England !) it

is evident that the natives will manufacture no other, simply because it is in demand. They may, probably, be led to increase the out-turn of soft goor like what is made in Bengal, but at present it is not what the chini manufacturers demand. The proposed changes, therefore, will apply to the manufacture of concrete.

These would be as follows :—

1st.—On no account allow any stock of cut canes to remain unused ; chop off therefore only the quantity necessary for each load of the "koloo" just before it is wanted.

2nd.—Instead of leaving the earthen vessel (nanah) below the "koloo" broad open, as it is now, cover it up with a wooden cover, closing as well as possible, and introduce through a hole in this cover a small pipe (leaders, if possible,) to bring the juice direct from the gutter of the "koloo" into the vessel.

3rd.—Burn, at least once a day in the vessel so closed, and when empty, one or two sulphur matches so as to feebly impregnate the cane-juice with sulphurous acid and prevent its alteration.

4th.—Wash carefully the said vessel as often as need be.

5th.—When the vessel is full, carry the juice into a deep pan, capable of holding the whole of the same; if found too expensive to have a metal pan, an earthen one will do. Mix slaked lime with water so as to form a milk of lime, and throw it in the pan at the rate of 0.50 of slaked lime to 100 of the juice. Heat the pan with a slow fire, and as soon as it approaches to a boil stop the fire; separate the froth which will be hard and well formed; let settle. The clear juice is carried to the evaporating pan, and the residue can be set aside in a vessel of some sort for further decantation.

6th.—The clear liquid, carried to the evaporating pan, should be evaporated without too strong a fire, and during the cooking agitation of the liquid will greatly aid the evaporation.

By these simple means, which cause only an insignificant outlay, I cannot say that the best of results will be obtained; but certainly the faults of the treatment now pursued by the natives of these districts will be greatly remedied, and a marked improvement secured; *viz.*, larger out-turn and better quality of sugar, that is, a larger grain.

The yearly average cultivation of sugar-cane in the Ghazee-
Production of the pore district is estimated at pucca
Ghazee-pore district. beegahs 1,50,000, which can be taken
to produce at the low average of 13 maunds Ghazee-pore per
beegah—

Concrete or bel...	...	...	Mds.	1,950,000
Calculating for the conversion of				
concrete into chini on an out-turn				
of 30 per cent. of chini, we obtain a				
total of maunds Ghazee-pore	..	„		5,85,000
Worth at present rates of chini 18 Rs.				
per maund	...	...	...	or Rs. 1,05,80,000

It can be safely asserted that by the proper manufacture of raw sugar, or goor, an increase of 50 per cent. at least in the out-turn of chini could be obtained; that is, 2,92,500 maunds

Cultivation of Chicory.

worth 52,15,000 Rupees; and this last figure can be said to represent correctly the value of the loss caused by bad fabrication.

It is true that the whole of that sum would not be profit; but deducting the cost of extra manufacture and the diminution in the quantity of "choa" or molasses, now consumed by the lower classes, there will remain still a sum of between 35 to 40 lacs of Rupees to represent the clear loss annually to the district by defective manufacture.

Calculate the area in sugar-cane in the whole of the Benares province, and you will arrive at an immense figure, representing a dead loss which an impoverished country can ill-afford.

Certainly I cannot pretend to a gain so considerable by the simple means I recommend, and which are make-shifts only, adapted to the resources at hand; but I firmly believe that by their adoption, a great step would be made towards the reduction of this immense waste.

GAZAREPORE, }
31st December, 1878. }

On Chicory Cultivation, by Indian Tea, Coffee, and Cinchona Planters, as an article of Export to England and Europe;
By CAPT. J. F. POGSON.

THE incomes and profits of the Planters alluded to would be considerably increased, if one and all undertook the cultivation of chicory in addition to the staples named. It takes from eight to twelve years to produce saleable cinchona bark. Three years for tea, and more for coffee. Now if chicory be sown and grown between these plants, it is manifest that annual crops of chicory root would be available for export, whilst the tea, coffee, and cinchona were growing.

The extent to which *siam* or chicory coffee is consumed is something marvellous, and as India is likely to produce first class root crops of chicory, it is advisable that those concerned

Cultivation of Chicory.

should enter on the cultivation as soon as suitable arrangements for securing seed can be made.

I have just received the latest edition of "Johnston's Chemistry of Common Life," and the information given beneath is taken from this deeply-interesting work. "*Succory*, chicory, or wild endive (*Cichorium Intybus*) bears large pale blue flowers, and has a large white parsnip-like tap root, which increases in size, when the plant is subjected to cultivation. This root abounds in a bitter juice, which has led to its use as a substitute for coffee. If these roots are vigorous, they will bear cutting two or three times, after which they are unproductive. The roots are taken up before the plant shoots into flower, they are washed, sliced and dried, preparatory to being roasted till they acquire a chocolate colour. Two pounds of lard are roasted with each hundred weight, and the dried root loses in roasting from 25 to 30 per cent. In Magdeburg several thousand acres are devoted to chicory culture; hence twenty to thirty millions of pounds of roasted chicory roots are yearly exported. The foreign is considered greatly superior to that of English growth, and is extensively imported into this country, chiefly through Hamburg and Antwerp. In 1876 the quantity of roasted root imported into England amounted to five thousand eight hundred tons. In France, thirty millions of pounds of roasted root are already consumed, and in Belgium twenty millions of pounds; while in some parts of Germany the women are becoming regular chicory toppers, and are making of it an important part of their ordinary sustenance."

That there must be something agreeable in the infusion of roasted and pulverized chicory root, is apparent from its extensive consumption in Belgium, where four-and-a-half millions of human beings, actually consume twenty millions of pounds of this popular substitute for coffee!!!

The British tea-vendor adulterates his "*choice mixtures*," prior to putting the compound up for sale, and "The coffee-

Tea Planting in the Andamans.

dealer adulterates his coffee with chicory to increase his profits; the chicory maker adulterates his chicory with venetian-red, to please the eye of the coffee-dealers; and lastly, the venetian-red manufacturer grinds up his colour with brick-dust, that by his greater cheapness and the variety of shades he offers, he may secure the patronage of the traders in chicory." Foreign chicory, on being landed in the United Kingdom, pays an excise duty of twelve shillings and one penny per hundred weight.

The British Government will have to be asked to admit Indian chicory duty-free, and then India will be able to develop this new trade and industry. But if the concession is refused, India will have to compete at a decided disadvantage with the Continental producer, for the more length of voyage and freight will tell against us; whereas if the duty be struck off, its amount will go towards paying the freight between England and India.

The cultivation of chicory is given in detail, at page 210 of the "Cottage Gardener's Dictionary," by George W. Johnson, Esquire, Editor of *The Cottage Gardener*, *The Gardener's Almanac*, &c. Publishers, W. Kent & Co., 51 & 52, Paternoster Row, London.

KOTEGURH, }
3rd July, 1879. }

Notes on Tea Planting in the Andamans;

By O. H. BROOKES, ESQ., SETTLEMENT OFFICER.

✓ The first plant raised in the Andamans were from a small quantity of seed sent to me in 1874 by Mr. Blechynden. I succeeded in raising in all about a dozen plants; these plants met with different fates, a few were killed by cattle grazing over the land after I left Navy Bay in 1874, and some perished for want of attention; some four or five plants however survived and were removed to South Point by Major Protheroe. By

SKETCH OF PORT BLAIR

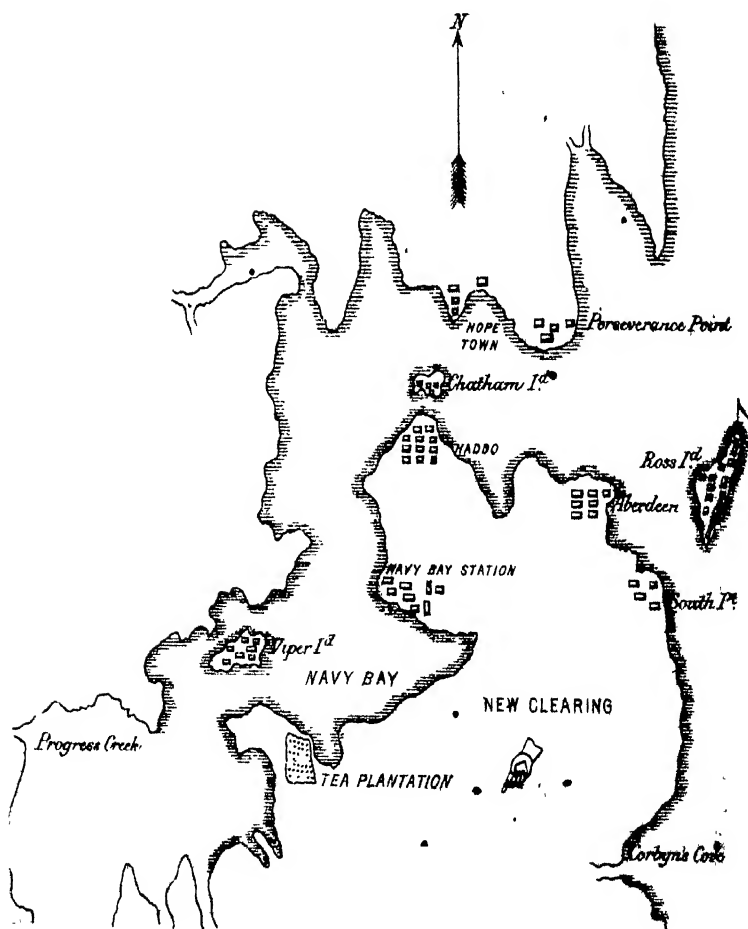
Shewing the site of the
TEA PLANTATION.



Scale 1500 Y^{ds} = $\frac{1}{2}$ an Inch.

590

0



this early experiment the fact was demonstrated that the tea plant could be grown in the Andamans, and although the first venture was on a very small scale and the success attending it not very encouraging, still we had seen enough to try again. Major Protheroe was of this opinion, and he obtained a large quantity (some maunds) of seed through the Secretary Agricultural and Horticultural Society. The seed arrived here about the end of the year 1877; it consisted of three varieties. The seed was sown in nurseries on undulating land about 150 feet above the sea level at the new clearing just above the southern side of Navy Bay. The position was well chosen as results have shewn. From what I can gather only about 25 per cent. of the seeds germinated, and of the Assam seed comparatively very few. The seed was sown on the 25th of February 1878, and germinated 25th April 1878. Of course some seeds germinated sooner, but all the seeds that were good had succeeded by the latter date. I may as well at once say that the Assam plants are, as far as I can judge at present, a complete failure. The plants, although planted at the same time as the China and hybrid, are sickly looking, and their existence is doomed: the plants from the other two varieties on the other hand are, for their age, a little over a year, fine vigorous plants throwing out fresh branches daily, some of the plants have shot up to a height of four feet, and they range from this to a height of two feet, but none are below this height. The garden contains at present—

				<i>Area of land.</i>	
China Plants,	3,600	...	...	6	Beegahs.
Hybrid	2,300	...	...	4½	„
Assam	1,010	...	...	3	„
<hr/>				<hr/>	
Total	6,910 Plants		...	13½	Beegahs.

I had a small quantity of tea manufactured lately from the more advanced plants raised from the China seed,

a specimen of which I send. It is of course picked prematurely, but it will give some idea possibly of what we may expect. I also attach a sketch, shewing the position of the Tea Garden, and I hope that the subject may be of interest to the Society. May we hope that the Andamans will some day have tea plantations, the result of private enterprize, dotted over the country.

NAVY BAY, }
8th May, 1879. }

Specimen No. 1, of tea from lower leaves. Plants planted 25th February 1878. Leaves picked 28th January 1879.

Specimen No. 2, of tea from upper leaves.

Report on the above Specimens; BY MESSRS. W. MORAN & CO.

Marks, &c.	No. of Packages.		London Value.	Cal. Equiv. Ex.
	No. 1.	As this tea is quite white with mould, we can only say that the leaf has been well twisted.		
	„ 2.	Rather irregular bright black broken Pekoe Souchong leaf, few orange tips, very coarse burnt flavour	1-1	7½
For leaf			value very	uncertain.

So far as make of leaf is concerned, these teas do not compare unfavorably with the usual manufacture of Assam and Cachar, but the flavour of No. 2 has been completely spoilt in the drying off. On the liquor of No. 1 we can of course give no opinion, the tea being quite out of condition.

Supplementary Note on Bamia Cotton ;

BY THE SECRETARY.

In May 1878 I submitted to the Society a paper entitled *Notes on a new variety of Cotton (Bamia) from Egypt*,”

Reana Luxurians.

which is printed in the Journal, Vol. V., page 245. I therein gave a brief account of a small experimental cultivation on this cotton in my own garden, and introduced a report on the produce from Messrs. W. Haworth & Co., who considered it rather inferior to some other samples raised at Hadjepore and Cawnpore as "harsher in staple and wanting in length and strength;" value about 6 to 6½ per pound. I then stated my intention of allowing the plants to remain as a biennial; "to ascertain if the next season's produce retains its character or deteriorates."

In March and April last I obtained a second gathering from the same plants, which had not been manured, nor otherwise cared for except ordinary pruning. This I have again recently submitted to Messrs. Haworth & Co., who have kindly favoured me with the following report thereon:—

"The color is very poor, which may be natural; but there is also much stained cotton. The staple, however, is capital, being long, strong and fine, and on this account alone the sample would rank as 'good fair,' Egyptian value about 8½ per lb. The seed is very similar to the ordinary Egyptian."

The color, I may add, is a light creamy tinge, which is I believe, a characteristic of the Sea Island variety. I hope to retain the plants for a third year to see the result of produce.

June 1879.

RESULT OF SOWINGS OF REANA LUXURIANS IN THE PUNJAB AND ITS DEPENDENCIES. (COMMUNICATED BY THE GOVERNMENT OF THE PUNJAB).

From Secretary to Government, Punjab and its Dependencies, to the Secretary, Agri-Horticultural Society, Calcutta, No. 266, dated Lahore, 7th March, 1879.

Revenue, Agriculture & Commerce.

SIR,—WITH reference to your letter of the 6th May last, I am desired to forward copies of the enclosed reports from Canal Officers in this Province on the results of sowings of the *Reana luxurians* supplied by you.

Reana Luxurians.

From Assistant Secretary to Government, Punjab, Public Works Department, Irrigation Branch, to the Secretary to Government, Punjab, No. 831.I., dated Lahore, 22nd February, 1879.

WITH reference to his No. 603 of 10th May 1879, under-

Report on the sowings on the Western Jumna Canal.	signed is desir-
Ditto ditto in the 1st Division, Bari Doab Canal.	ed to forward
Ditto ditto 2nd Division, Bari Doab Canal.	copies of the
Ditto ditto Upper Sutlej Division, Inunda-	reports margi-
tion Canals.	nally noted on the results of sowings of the <i>Reana luxurians</i> .

Report by the Superintending Engineer, Western Jumna Canal Circle, on the results of sowings of Reana luxurians seed on the Western Jumna Canal in the current year 1878.

A SMALL packet of this seed was received at the beginning of June, and half of it was given to each of the Executive Engineers of the Karnal and Delhi Divisions, who were requested to report on the results after the rains.

Major Swinton, Executive Engineer, Karnal Division, sowed half of the seed given him in the compound of the Canal Office at Dadupur, in which there is a well from which the *Reana* was watered, and the result was a most flourishing crop.

The other half of the seed was sown in an irrigated plot of ground adjacent to a field of jowar on the right bank of the Sombe torrent, in which the spring level is 7.50 feet below the surface and the level of the field 5.30 feet above the water level of the canal; the crop on this plot came up well at first, but afterwards withered away, though the adjacent field of jowar gave a good crop.

Mr. Phelan, Executive Engineer, Delhi Division, sowed some in the Israna Chowki compound, which gave a favorable result, having been irrigated from the Chowki well.

The remaining portion he sowed at the Saragthal Chowki, where the crop had to depend on the rains, and the result was a failure, though the neighbouring jowar gave a very superior crop.

It would, therefore, appear that without irrigation the *Reana luxurians* will not thrive, and is useless in a dry country like this part of India.

Both the Executive Engineers state that the crop is not so valuable or abundant as jowar, and is therefore an inferior crop for fodder.

Report on the cultivation of Reana luxurians in the 1st Division, Bari Doab Canal.

UNDER instructions conveyed in No. 1456, dated 4th May 1878, the seeds received with Superintending Engineer's No. 1654, dated 22nd May 1878, were distributed among the subdivisional officers with instructions for their sowing and reports of their results called for, which are as follows :—

*Report by the Assistant Engineer, 1st Sub-Division, 1st Division,
Bari Doab Canal.*

Of the 50 seeds of this plant received from Executive Engineer towards the end of last May, 31 plants germinated; the seeds having been sown on the 8th July in the plantation garden on the island, 10 of young plants were transplanted 3 weeks afterwards, and placed in the mango plantation garden on the high bank, and 5 of them were transplanted to the Mullikpur garden. The 10 plants in the mango plantation have done fairly. They are now about 8 feet high, and seed pods are sprouting well: about 50 seeds have already been collected.

The 16 plants left in the island garden were cut by some unknown person overnight towards the middle of November. Eight of them recovered, and are now about 2 feet high; have vigorous shoots, and are beginning to flower; the remaining 8 have not recovered, and are now dead.

Those transplanted to Mullikpur garden have all died. Of the 31 original plants therefore 10 are in a good condition, and likely to yield an ample quantity of seed for next year's sowing attempt, and 8 have recovered after having been cut, and may be expected to yield a small quantity of seed.

*Report by the Executive Engineer, 2nd Sub-Division, 1st Division,
Bari Doab Canal.*

THE seed was sown in the beginning of the rains (6th July)

When sown. in the following manner:—

How sown. One-half in a small plot for transplanting, the plot being manured and watered:

and one-half in plots described in part II of this report.

Transplanted Plants.

The seed was sown on the 6th July, the plants appeared above ground on the 12th and 13th, and were transplanted when about 6 inches high; one-half into a plot without manure, and which has received no irrigation; the other half into a plot manured and irrigated.

The bush or fodder part of those in the unirrigated plot grew to an average height of $3\frac{1}{2}$ feet, and the seed stalks to about 6 feet; the width of bush being about $2\frac{1}{2}$ feet on an average.

The other half of the plants were transplanted into a manured plot, which has been regularly irrigated once a week, grew to an average height of $5\frac{1}{2}$ feet in the bush, the seed stalks having shot up to from 9 to 10 feet high; but though the height was so very much more than in the "barani" plot, the width of bush was only from 3 to $3\frac{1}{2}$ feet

in the largest of them. These two plots were land which had been used as part of the garden for the last 4 years.

Plants how far apart.

The plants in both plots were transplanted 6 feet apart.

II.—Seeds sown in plots and not transplanted.

As sowing in garden land could not be considered a fair test of what might be expected when sown by zemindars in their fields, I made 4 plots in the land, which was added to the compound nearly 3 years ago, and which has not been used since.

The plots were as follow:—

Description of plots not in garden land.

First plot manured and irrigated.

Second plot manured but not irrigated.

Third plot irrigated but not manured.

Fourth plot neither manured nor irrigated.

Distance apart of seeds.

The seeds in all the plots were put in $4\frac{1}{2}$ feet apart.

Description of land.

I may here state that the land is sandy and light.

Plot No. 1.—The plants in this have grown to about 5 feet in height, and unlike those in the richer land in the garden, the seed stalks are not much higher than the bush part: the width of the larger bushes being about 3 feet.

Result of sowing in plot No. 1.

Plot No. 2.—The plants in this grew to about 2 feet in height and then died off, except the two plants next the watered plot, which have grown to nearly $3\frac{1}{2}$ feet high, but with little bush; they have evidently been kept alive by the water in the other plot keeping the earth near their roots more or less.

Result of sowing in plot No. 2.

Plot No. 3.—The plants in this have grown about $2\frac{1}{2}$ feet high, but have little or no bush to speak of.

Result of sowing in plot No. 3.

Plot No. 4.—The plants in this grew about $1\frac{1}{2}$ feet high during the rains, and then died off.

The total number of seeds received was 60, and about two-thirds of what was sown in each plot germinated.

Conclusion drawn from the above.

From the above it would appear that—

1st.—To have the plants 6 feet apart is quite unnecessary even in good land, irrigated and manured; from 4 to $4\frac{1}{2}$ feet under the most favorable circumstances would be sufficient, and for ordinary sowing by zemindars, 3 to $3\frac{1}{2}$ feet.

2nd.—That it requires to be irrigated. The plot in the garden which has not been watered can hardly be taken as a fair test, as it is only 12 or 13 feet square, and the ground all round has been regularly

irrigated, so a certain amount of moisture has reached the plants. One thing should be noted, *viz*, that the rains stopped much earlier this year than usual, and it is possible that with rains up to the usual time a certain amount of crop might be got from stiff, strong lands which would retain the moisture much longer than the sandy soil at Jandiala.

3rd.—The Government memorandum says to transplant, while Mr. Halsey says not to. As regards the plans, I think it is immaterial which plan is adopted. The transplanting was done in the usual manner for plants of the sort, no particular care being taken, and no plants were lost; but I think transplanting should be recommended, as owing to the distance between the plants, it takes very little labor, and would save something in water where well irrigation has to be used, and give the zemindars more time to prepare the ground.

4th.—That in at least ordinary land it requires manuring. See the result of plot No. 4. The plot in the garden, which was not manured, could not be taken as what might be expected in ordinary land, as it is richer than what most land would be with manuring.

5th.—Outturn. This I have not attempted to ascertain, as no trustworthy idea of what might be expected from a field could be deduced from the few plants (about 40), which I have distributed as they are; besides to have cut them twice might have endangered getting seed, as Mr. Halsey noted in his memorandum that it should be sown in April if seed was wanted after two cuttings. The plants in the irrigated plots and in the unirrigated plot in the garden are seeding very well.

I would suggest that at least half an acre, if there is seed enough, should be sown next year in Mainhalla compound, the land there being a fair average of the kind of land in this sub-division, and the only large compound which can be easily irrigated.

A fair estimate of the out-turn to be expected under ordinary circumstances would thus be obtained, and I have no doubt some of the *Tehchal* cultivators would be only too glad to keep their bullocks at the chouki during the night, or when not working, while the cutting of it lasted, and by feeding them with it a pretty accurate idea of its profitableness as a fodder would be arrived at.

Report by the Assistant Engineer, 3rd Sub-Division, 1st Division, Bari Doab Canal.

THE seeds of *Reana luxurians* were sown in the commencement of the rains, but when they were growing up the plants

Reana luxurians.

were eaten by cattle, owing to the neglect of the man in charge, and consequently came to nothing.

Report by the Executive Engineer, 2nd Division, Bari Doab Canal, on an experimental sowing of the Reana luxurians, or Euchleana luxurians.

A PACKET of seed was received from the Superintending Engineer on 22nd May 1878; it was divided into two portions—one was sent to Mr. McLaughlin, for experimental sowing on a portion of Canal bank at Pumbay in the Lahore district, tahsil Kasur, and the other portion was sown in Amritsar in the Rambagh.

2. The seeds were sown on the 6th June at Pumbay, and on the 6th of July at Amritsar, in well-ploughed and fairly-manured soil, and germinated fairly; the plants were then transplanted to a distance of 3 feet apart and were carefully attended to, being kept free from weeds, and only occasionally watered. By the 17th of September the plants averaged a height of $9\frac{1}{2}$ feet each, had tillered out to an extraordinary extent, as many as 15 to 17 shoots springing from one plant, very vigorous canes full of leaf, making the space between each plant of 3 feet much too small.

3. The plants continued to thrive and extend in height and volume till October, when some of the most healthy and vigorous attained a height of 15 feet, the average being $12\frac{1}{2}$ feet. Signs of seeding made their appearance towards the end of October, the male flowers coming last, and were much checked by the early frost in November; the cobs, however, were impregnated and seeds germinated freely, and were finally ripened and gathered on 4th January. The yield has been good, e. g., the quantity sown at Pumbay was 170 seeds, and their weight about one ounce, their yield was 18 seers.

4. The seed cobs were arranged along the stems, and averaged about 10 in number to each stalk.

Cattle eat the forage with great avidity, when it became necessary to thin the plants to give air and room to their neighbours.

5. From the experience gained, it appears advisable to sow the seeds as early as possible. The middle of May suggests itself where irrigation can be supplied, in order that the plants may be matured more early in the season before the frost can act injuriously on the blossom, preventing the cobs from attaining maturity.

6. A considerably more extensive area will be sown this year a little earlier in the season.

In both cases the experiment has been most successful and encouraging: many cultivators in the neighbourhood of Pumbay and Amritsar came to see the plantation, and expressed their surprise at the abundant profusions of the out-turn.

Report by the Executive Engineer, Upper Sutlej Division, Inundation Canals, on the growth of Reana luxurians.

A SMALL lucifer box of the seed of *Reana luxurians* was received at the end of May 1878, with instructions that the seed should be sown at the commencement of the rains.

As the rains usually commence in this Division at the beginning of July, the seed was sown on the 20th June in the compound at Mamoki, the head-quarters of the Division, and watered from the well which supplies the garden. No canal land was available where the crop could be properly looked after, and as the supply of these canals is so uncertain, it was thought better to plant it on "well" land.

The land was prepared and manured with common village manure, as it would be for any well crop, and the seed sown on ridges 3 feet apart and at intervals of 3 feet on the ridges.

The seed germinated well and resulted in 170 plants. These grew vigorously and threw out numerous shoots, (from 20 to 40 to each plant) and by the end of October were from 10 to 12 feet high when they commenced to flower. They continued flowering through November and December, sending forth fresh flower shoots from the joints, and were not affected by the early frosts in December, but the severe frost of 24th December (in Lahore the thermometer registered 70° Fahrenheit) killed the whole of the plants.

They were then cut down and the ripe seed collected. This amounted to nearly 20 seers, besides which there were 10 seers of unmaturing seed. Had the whole ripened, there would have been at least one maund of seed from the 170 plants. Whether the ripe seed had suffered from the severe frost remains to be seen.

After the seed had been collected, the stems were chopped up and mixed with bhusa and given to the well bullocks. They did not like it at first, but ate it well in two or three days.

None was cut green as fodder, as the plants were so few. A few stems only were given to horses and bullocks, which they devoured greedily.

It appears that the seed should not be planted later than the end of April or the beginning of May in this part of the country, it would then ripen before the frosty weather.

Birds did not attack the seed at all, probably on account of its very hard shell, but squirrels did considerable damage to the half ripe seed.

It is proposed by Executive Engineer to sow two plots this year at the end of April—one to be cut green as fodder, and the other to be left for seed without cutting.

Cultivation of Manilla Hemp.

On the cultivation of Manilla Hemp at Port Blair, and at Vyteri in Madras.

We should be much obliged if you could kindly obtain for us a report on the accompanying two samples of fibre extracted from Manilla hemp, (*Musa textilis*) grown at Vyteri in Madras and at Port Blair.

DEPT. OF REVENUE, AGRICULTURE
AND COMMERCE,

} J. E. O'CONOR.

Calcutta, 21st May, 1879.

Report on the above samples ; BY MR. JOHN STALKARTT.

Calcutta, 6th June, 1879.

I CONSIDER the sample from Port Blair very creditable, and if procurable at a reasonable rate it will soon become an article of commerce. It is not quite equal to Manilla, of which I send a sample for comparison. An attempt should be made to obtain a longer fibre, say at least six feet. Manilla runs from 6 to 8, and if the fibre could be a little more bright and glossy it would materially add to its value. The sample of heckled Manilla which I send will be a good guide for color, and I have heckled a small portion of yours in order that you may compare the two. The water in which the hemp is steeped should, if possible, be a running stream in which the impurities would be at once carried away. I would suggest that the plant be tried on different soils, and I am of opinion that a sandy soil will answer best, the plant will have less of the mucilaginous matter which is so difficult to get rid of; a stiff dark clay increases the difficulty of preparation.

The value of Manilla hemp is now 16 Rupees a cwt., your sample is worth about 10 to 12. The sample of unchecked Manilla, which accompanies yours, may be retained as a guide for quality and value.

The Madras sample is much too small to test, it is greatly wanting in strength, and appears to have been steeped in

dirty water which may account for the bad color. Being so much out of condition a value cannot be given.

From Officiating Secretary to the Government of India, Home, Revenue, and Agricultural Department, Simla, dated 14th July, 1879.

I AM directed to convey to you the thanks of the Government of India for the report on the samples of Manilla hemp produced at Port Blair and in Madras, with which you kindly furnished Mr. O'Connor in your demi-official letter of the 7th ultimo.

2. The Port Blair plants were raised by means of propagation from a single specimen obtained at the end of 1873, through the Superintendent of the Botanical Gardens, Howrah; and there were in December 1876 forty-eight plants of different ages growing in the Royal Dover Gardens. Of the present condition of the experiment full particulars are not, as yet, available. A copy of the most recent report of the Chief Commissioner and Superintendent is herewith enclosed; and on receipt from him of the further information which he has now been asked to furnish, it will be communicated to the Society.

From the Chief Commissioner and Superintendent, Andaman and Nicobar Islands, to the Secretary to the Government of India, Home Department, dated Port Blair, the 1st April, 1879.

WITH reference to letter No. 19 of the 31st January 1879, from the Department of Revenue, Agriculture and Commerce, received with your endorsement No. 34 of the 13th February, I have the honor to state that some of the largest plants in the Manilla hemp plantation have been cut down and fibre has been prepared from them at a cost of six annas and nine pies per pound. The fibre was extracted by hand labour, men in the convalescent gang being employed for the purpose; whose labour is valued at two annas per diem.

32 *Trials with certain Manures on Tea Gardens.*

A sample of 4 pounds of the fibre is being sent by this mail to the Secretary to Government of India, Revenue, Agriculture and Commerce Department, and I shall be glad to know what is thought of it.

2. The plants in the plantation have not increased to any great extent, and most of them are still too small for manufacturing purposes. Whether this is due to the soil being unsuitable or not, I am unable to say; but it is intended to remove some of the young shoots at the commencement of the rains to another part of the settlement, in order to see if better result can there be obtained.

Result of trials with certain manures on Tea Gardens in Assam, Cachar and Chittagong.

PRESS of work has prevented me from affording you the information on the results of applying manure to the tea plant, and the short notice given by your letter of date precludes me from giving you more than a few figures. On an old garden in Cachar, with sandy soil and low undulating teelahs, we obtained the following results from different modes of treatment. By applying

1. *Farm yard manure*, we got an increase
of $27\frac{1}{2}\%$ or 41 lbs. tea per acre planted $4' \times 4'$
2. *Oilcake* ... 51% „ 77 ditto ditto
3. *Greenjungle*... 27% 40½ ditto ditto
4. *Bheel soil* ... 78% 116½ ditto ditto

The former was applied about 20 lbs. to a bush.

No. 2, $\frac{1}{2}$ to 1 seer per bush.

No. 3, trenches dug and filled in with jungle cut from the hollows.

No. 4, the bushes were earthed up with soil carried up from the hollows.

Memo. shewing extra yield from 100 bushes manured with oilcake, each bush receiving 1 lb. (three experiments). Season 1876.

	Description of bushes and how planted.	Yield in leaf from 100 un-manured bushes.	Yield in leaf from 100 manured bushes.	Extra yield from 100 bushes from manuring.	
				Leaf.	Tea.
I.	Large old bushes planted 6 × 3	} 96 lbs.	118 lbs.	22 lbs.	5½ lbs. 28°/o
II.	Large healthy bushes planted 3 × 3 ...	} 79° "	105 "	26 "	6½ " 33°/o
III.	Young bushes planted 4 × 4 in 1873 ...	} 28 "	39 "	11 "	2½ " 39½

Cost of 100 lbs. Oilcake at 10 annas per md.	...	Rs. 0 12 6
" applying do. to 100 bushes	...	" 0 8 0
		Rs. 0 15 6

Less cost of opening out and closing roots of 100 un-manured bushes	...	" 0 2 4
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Extra cost of Oilcake, and applying same to every 100 bushes	Rs. 0 13 2
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No. I experiment was tried upon fine old bushes planted 6 feet × 3 feet apart, and you will observe both unmanured and manured bushes give more leaf than those of Nos. II and III experiments. If a full acre of equally good bushes were treated in the same way, the yield per acre would be if unmanured, 7 mds. 20 lbs. Tea and if manured 8 " 73 " , ,

Increase lbs. 133 at Re. 1 per lb. 133
Cost of manuring 19-14
Profit per acre .. 118-2

Upon the part of the teelah, where the above 100 bushes were fenced off, there were about 12 per cent. vacancies.

No. II experiment was tried on bushes large and healthy planted 3 feet × 3 feet apart on one of the best spots of the garden, and a full acre of equally good plant would give if unmanured ... 11 mds. 75 lbs. of Tea, and if manured ... 15 " 70 " , , ,

Profit, ...	Rs. 275-4 per acre.
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but it must be noted that there are twice as many bushes in an acre planted 3×3 as there are in one planted 6×3 , and therefore there would be twice as many bushes to open out, (i. e. the acre would get twice as much of this sort of cultivation) and twice as much oilcake would be required in order to give each bush 1 lb. as to acre planted 6×3 . The vacancies on the part where No. II experiment was tried were about 24 per cent.

No. III experiment was conducted on bushes planted 4×4 in 1873, and the result from a full acre if unmanured would be 2 mds. 30 lbs.

and if manured, would be 3 „ 25 „

Profit, Rs. 23-8 per acre.

Although the account of the leaf was carefully kept, I think the yield as obtained from it is too large, although the proportion of increase would be right. In the commencement of the season when the yield of leaf from each 100 bushes was very small, an error might have arisen, as it is difficult to weigh correctly small quantities on our well used scale. It is also to be noted that small patches railed off shew higher yields than the rest of the teelah in every case where it is tried.

The bushes of Nos. I and II experiments were large well-matured bushes, and in calculating the yield per acre in order to apply it to Borakai teelahs, a large deduction on account of vacancies, small bushes and bad parts, would require to be made.

Cachar, 13th June, 1877.

The profit per acre planted $4' \times 4'$ according to

result of experiment I, would be	...	Rs. 128	5	0	
Calculated on the number of II would be		156	1	0	
Plants exclusive of vacancies III	ditto	23	8	0	
		Rs. ...	307	14	0
Average per acre	Rs.	102	10	0	
Against	„	69	2	3	

Cachar, 17th July, 1878.

Bone-dust has had a marked effect wherever applied. The 600 pounds were distributed on the three divisions, the majority on ——— as it suffered so severely from red spider. I cannot yet say anything regarding its deterrent effect on blight, but am watching its effects.

E. Ferguson, 1st January, 1879.

The oilcake applied last year has yielded the most satisfactory results, but owing to our having plucked finer leaf than in former years, the difference of yield does not fully show the advantage gained. The difference in the appearance of the bushes and vigour of flush indicate it very plainly here. The vegetable ash manure has also given fair results, but scarcely equal to the oilcake.

E. Ferguson, 1st April, 1879.

RESULTS OF MANURING ON TRIAL.

Result up to 16th ultimo.	1st Plot south.	2nd Plot to N. of No. 1.	3rd Plot to N. of No. 2.	No. 4 Plot N. of all.
	400 nulls, 3,630 bushes, with 1 lb. oilcake and $\frac{1}{2}$ lb. wood and charcoal ashes well mixed.	398 nulls, 3,630 bushes 1 acre manured with 11 cwt. of vegetable ash manure mixed with five times its bulk of saw-dust.	380 nulls, 3,630 bushes. No manure.	389 nulls, 3,630 bushes manured with oilcake only per bush.
	67 lbs.	70 lbs.	60 lbs.	80 lbs.
	560	455	372	482

Chittagong, 19th May, 1868.

I note your remarks upon the Guano, and agree with you that some less expensive manure might be tried. The quantity of Guano given to each plant was from one to one-and-a-half ounces, or between 2 and 3 mds. per acre. The mode of application was as follows:—On flat land I made a trench all round the plant 8 to 10 inches from the stem (these were

young plants) and sprinkled the Guano lightly in it, covering it over with the earth again, and in hilly land I only made the trench above the plant. I do not observe that it has made any change yet, and in plucking the leaf from 2 acres, one manured and one not, I only found a difference of half a pound, the former giving $17\frac{1}{2}$ lbs. of leaf, and the latter 17 lbs.

27th August, 1868.—I may mention that the manured portion of the garden does not shew such improvement as was anticipated, the plants are, little larger than those not manured, and the out-turn of leaf only shews a difference of 30 lbs., viz., 208 lbs. against 178.

MEMO. OF YIELD.

Date.			Manured.	Not Manured.
May 6	...	...	$17\frac{1}{2}$ lbs. leaf.	17 lbs.
" 20	...	...	$23\frac{1}{2}$ "	20 "
June 7	...	...	46 "	46 "
July 9	...	...	48 "	40 "
" 27	...	...	18 "	10 "
August 13	...	...	55 "	45 "
September 14	...	...	56 "	42 "
October 17	...	...	58 "	54 "
November 25	...	...	40 "	42 "
			362 lbs. leaf.	316 lbs. leaf.
Tea say	...	...	$90\frac{1}{2}$ lbs.	79 lbs.

Extracts from a Cachar Tea Planter's letters, describing the effects and value of bone-dust as a tea plant manure.

21st May, 1876.

The bone-manure was applied mixed to the roots of the bushes at the rate of 4 maunds per acre on the 14th March.

Cultivation of Ground-Nut.

4th February, 1877.

The 50 maunds bone-dust was mixed and applied at the rate of 4 mds. per acre. I chose a flatish teelah of 25 acres, 13 of which were left unmanured. The soil was stiff clay, the manured acres gave $4\frac{1}{2}$ mds. of tea per acre against $3\frac{1}{2}$ mds. from the unmanured. There was a marked difference in the appearance of the bushes, the manured ones being dark green, and much more vigorous.

26th February, 1878.

The bone-manure I consider the most beneficial that has yet been applied to the plant. The plants on one teelah had formerly presented a sickly yellow appearance; have since the application become quite vigorous and are of a dark green colour.

11th June, 1878.

With reference to the bone-dust, No. — which is almost flat, has not had either blight or red spider any way; had more application of bone-dust in 1876.

Cultivation of the Ground-Nut in India.

(Communicated by J. E. O'CONOR, ESQ.)

Arachis hypogæa (N. O. *Leguminosæ*). Ground-nut, Manilla-nut, earth-nut, pea-nut, pig-nut. Vernacular synonyms: *China badám*, *Vilaiti Moong*, (Hindustani), *Moong phalli* (Bengali), *Myé-bye* (Burmese), *Ver kadale*, *Vella kadale* (Tamil), *Katjang* (Malay).

From the seed is expressed a considerable proportion, varying according to circumstances from 33 to 50 per cent. of the weight of the husked seed, of excellent oil of a light greenish colour, very clear and bright, largely used in Europe and in India for illumination. It is also used for the table mixed with olive oil, for which it is a good substitute, and for the lubrication of machinery. The oil is good for every purpose for which olive and almond oil are used; it makes good soap, and has the advantage of not quickly becoming rancid and of burning without smoke. The nut is eaten, roasted, by natives, and occasionally by Europeans in this country. It is of universal consumption in the United States and by Spaniards both in Spain and in America, roasted and in confectionery. The green plant forms excellent fodder for cattle, and the cake left after expression of the oil is a valuable cattle food and manure.

In a Resolution, No. 514-24C., dated the 2nd November 1877, issued by this Department, [Revenue, Agriculture, and Commerce] it was pointed out, with reference to the cultivation of the sunflower (*Helianthus annuus*) which had been progressing for some time at Bangalore, that it is of more importance to stimulate and develop the production of articles already known and cultivated in the country than to initiate costly experiments in articles not commercially known, and of which the ultimate success is problematical. One of such known articles, it was said, was the ground-nut. The following is an extract from the Resolution :—

"6. In connection with this subject, the Governor-General in Council thinks it opportune to record his opinion, that it is of more importance to stimulate and develop the production of articles already known in the country than to initiate costly experiments in articles not commercially known and of which the ultimate success is problematical. One of these articles is the ground-nut (*Arachis hypogæa*). The kernel of the pod of this plant produces a very large proportion of excellent oil, extensively used in Europe as well as in this country. The plant grows abundantly in the Madras Presidency and elsewhere, but it does not seem to be fully utilised. The exports of the nut to foreign countries in 1875-76 were, from Madras, 6,994 cwt., value Rs. 29,774, and from Bombay, 3,721 cwt., value Rs. 13,845. From Bengal the exports have been so trifling that they had not been separately distinguished. The plant is grown to some extent in Burma, but not sufficiently for local consumption, and quantities are imported from Madras.

"Although the exports to foreign countries from British India are trifling, considerable quantities are sent from Pondichery to France, as will be seen from the following figures, which have been extracted from the French trade returns of 1875 :—

	Kilogrammes.	Value. Francs.
Imports from British India ...	1,231,803	406,494
" " French India ...	6,404,899	2,113,616

"The total imports into France in the year from all countries were 101,524,468 kilogrammes, or nearly 100,000 tons, worth 33,503,000 francs.

"Thus, out of this total value of 33½ millions francs, only 2½ millions stand against India, of which French India has by far the largest share. Nearly all the rest is imported from the western coast of Africa.

"7. The French trade in ground-nuts is a large and increasing one, the extraction of the oil, which is in considerable demand for the manufacture of soap, for consumption as food, and for other purposes, being conducted on a large scale at Marseilles. If the cultivation can be developed in this country, it seems probable that British India should be able to compete with Africa and supply France with a very considerable part of her requirements of this article, adding the ground-nut to other oil-seeds, such as gingelly and rape, which are now exported to France in great quantities.

"8. The Governor-General in Council requests that the local

tent of its cultivation in their provinces, and to report them with any particulars they can ascertain as to the consumption of the seed and oil in the country. His Excellency in Council will also be glad to be favoured with any suggestion they may wish to make as to possible development of the cultivation and trade. In the maritime provinces it is desirable that the export trade should be recorded in the monthly and annual returns, and this should be done with effect from the 1st of April next, in both the foreign and coasting trade returns."

Th replies to this Resolution are summarised below :

1. FROM BOMBAY.

Not cultivated anywhere in Sind, but imported for sale and to be found in all bazars ; is roasted and eaten by the natives, and is very generally used. Several officers have evinced a desire to try its cultivation.

Not cultivated except to a very trifling extent in the Northern Division of the Bombay Presidency. In 1877 it was experimentally cultivated in one field in Ahmedabad, and on a small area in the Surat district, where it produced about 1,238 Bengal maunds, which were locally consumed for food purposes. Importation into this division is on a very small scale, the nut being merely used for food, and not for manufacturing oil ; and any development of the export trade must be looked for elsewhere than in the Northern Division, a very great part of which is not well suited for the cultivation of the nut.

The Collector of Násik states that the ground-nut is grown in almost all the talukas of that district in land irrigated by páts as a rotation crop ; that not more than from 1,000 to 2,000 acres are cultivated with it in any one taluka ; that the nut is used as food ; that oil is also extracted from it, generally for the purpose of adulterating other oils ; that the crop requires a good deal of water ; and that about half the produce is consumed within the district, the remainder being exported to Bombay.

The Collector of Khandesh reports that in 1876-77 ground to the extent of 2,151 acres and 37 gunthás was cultivated with the ground-nut in his district, and subjoins remarks by Messrs Blathwayt, Woodward, and Stormond to the effect that—

what is grown is used for food almost entirely, and is consumed within the district ; that a small portion is used for the production of oil, which is employed chiefly for adulterating other oils ; and that the crop is grown on irrigated land, and is not profitable in comparison with other garden produce.

The main objection to the ground-nut as a regular oil crop is that, in Khandesh, where the soil is mostly tenacious and cloddy, it is difficult to recover all the nuts from the ground, so that some always remain in the ground, and by germinating become a troublesome weed.

The Collector of Ahmednagar reports that a small area (between 1,100 and 1,200 acres) of land is cultivated with ground-nut, that good soil is necessary for its cultivation ; that it is

Cultivation of Ground-Nut.

invariably an irrigated crop ; and that the expenses of cultivation are great, but that the profits are in proportion and generally exceed those from other crops usually grown on soil of similar description to that on which the ground-nut is sown.

The Collector of Poona roughly estimates that about 21,000 acres are cultivated with ground-nut, chiefly in Khed taluka. He says that it requires irrigation and can be grown on almost any soil, but flourishes best on red and stony ground ; that it is a more profitable crop than any other ; and that about three-fourths is converted into oil and the rest used as food on fast days. He is of opinion that, if an export trade could be started from Bombay and agents established in the mofussil towns to purchase the nut, the cultivators would learn its value, and the crop could be grown to almost any extent required.

The Acting Collector of Sholapur reports that land to the extent of about 15,000 acres, chiefly in Bársi taluka, is cultivated with the nut which is grown in soft, black and reddish soil, and is used as food by the poor to a small extent, and by Hindus generally on fast days. He states that oil is extracted from it to a great extent for lighting and other purposes, and that it is said to be a very profitable crop where it can be grown without irrigation, and moderately so elsewhere.

The Collector of Satara reports that about 29,000 acres are annually cultivated with the nut in that district ; that it is generally grown on good soil, but irrigation is absolutely necessary for its proper growth ; and that the profits from its cultivation exceed those from other cereals* usually grown on similar soils.

In submitting these reports from the Collectors of his division, the Commissioner, Central Division, says that—

The nut is chiefly grown in the Satara, Sholapur, and Násik Collectorates, and he has no doubt that should a demand for the nuts spring up in mercantile circles, its growth would be largely and rapidly extended, as it is said to be a very paying crop

The Commissioner, Southern Division, states that the ground-nut is cultivated to a limited extent in two talukas of the Belgaum district only, and 75 per cent. of the produce is consumed locally, and that in the remaining districts of that Division it is imported in small quantities for local consumption, and is mixed with kardî, usemba, or safflower, the oil thus extracted being used for culinary and lighting purposes.

The Government of Bombay adds generally that the nut is grown in that Presidency almost entirely for local consumption, but that should any great demand for the crop arise, an immediate and large extension of the cultivation would undoubtedly result.

2. FROM BENGAL.

The ground-nut, it is stated, is not grown as an article of trade. The following paragraphs contain such particulars as

* *Note.*—It is a leguminous plant, not a cereal.

Cultivation of Ground-Nut.

have been furnished of its cultivation in the Lower Provinces of Bengal:

Presidency Division.—Grown to a very small extent, and little consumption of the seed or oil.

Patna Division.—Not grown, except to a very limited extent in the gardens of some of the rich natives of the Hajepore sub-division of the Mozufferpore district, and in the Chumparun district.

Rajshahye and Cooch Behar Divisions.—Not grown. From a private experiment made by him, Mr. French, Manager of the Court of Wards' Estates, Dinagore, thinks that the nuts might grow in Dinagore.

Chota Nagpore Division.—Unknown except in Hazaribagh, where it is cultivated in the town on a very small scale as a desert fruit by a few gentlemen.

Bhágálpur Division.—Not grown, except occasionally in the gardens of a few planters in the Muddehpoorah sub-division of the Bhágálpur district, and to a small extent as an article of luxury in the Purneah district.

Burdwan Division.—Not grown, except to a very small extent in the Beerbhoom district, where it is used as an article of food, but not of commerce, and in the gardens of a few well-to-do natives in Hooghly.

Chittagong, Dacca, and Orissa Divisions.—Not grown.

3 NORTH-WESTERN PROVINCES AND OUDH.

Mr. Buck, Director of Agriculture and Commerce, states that his attention was drawn to this product from his having noticed the enormous extent to which it is cultivated in America under the name of pea-nut. The nut is little grown in the North-Western Provinces, but it is found in market-gardens near towns under the name of *Mung-phalli*. It requires a sandy soil, and perhaps wants a moister climate than the North-Western Provinces can give it, but may succeed with canal irrigation. In the North-Western Provinces it appears to be used as a luxury, and no oil is extracted from it, nor is it exported. It is cultivated as a garden, and not a field crop.* The only districts in which it is known to have been grown are Banda, Hamirpur, Jaunpur, and Mirzapur; it is sown in the months of June and July, and the crop is cut from December to February, the out-turn being from $4\frac{1}{2}$ to 15 maunds per acre. It is chiefly used for food, though in Banda and Mirzapur oil is said to be extracted from the seed. The green leaves are readily eaten by cattle, and when rotted make excellent manure. It is occasionally imported into the North-Western Provinces from Gwalior and Jubulpore. Experiments with the plant have been undertaken in the Government Farms at Cawnpore and Allahabad, and in the Lucknow and Saharanpur gardens with the results reported below:

The experiments at Saharanpur were made partly with seed raised in the gardens during the previous year, and with seed obtained from Bengal. 1 lb. 3 ozs. of the former seed gave an out-turn of 61 lbs., being almost 49 fold, and 8 lbs. of the latter seed yielded 192 lbs. or 24 fold. There was no apparent difference in the size of the nut or quantity of the crops.

In the Lucknow horticultural gardens 6 lbs. of Bengal seed sown, give an out-turn of 192 lbs. or 32 fold. The land was ploughed three times and manured at the rate of 400 maunds per acre; the crop was irrigated four times and weeded twice. The area on which the seed was sown was 1.164 yards, which gives a rate of yield per acre of about $9\frac{1}{2}$ maunds. The value of the produce at 4 seers per rupee would be Rs. 97.8 per acre. This compares favourably with the value of the produce of an acre of sugar-cane, which, under the same amount of cultivation, is estimated at Rs. 70.

Bengal seed was sown at the Allahabad and Cawnpore Government Farms, but the result in both places proved a failure owing to want of proper management, the out-turn per acre at Allahabad being only 90 lbs., and at Cawnpore somewhat less.

Mr. Buck believes that the nut can be cultivated with profit only in the damper Sub-Himalayan regions where the climate most closely approximates to that of Bengal. It is well known at Cawnpore and other places.

4. FROM THE PUNJAB.

Unknown in most districts as an article of local cultivation. Imported into Delhi from Bombay and Gwalior, and into the neighbouring districts from Delhi; generally sold by the vendors of dried fruits at the rate of 8 annas a seer. Used in small quantities as food like pistachio nuts, but its use as an oilseed is unknown. The value of the nut cannot be judged from the few experiments made with it in all three districts; but seeing that the zemindars are averse to the introduction of any new products, it seems doubtful whether the cultivation of the nut would be successful in the Delhi Division. Suggests that a few experiments might be tried in the Government garden in each district.

Hissar.—Not cultivated. Some years ago the Deputy Commissioner (Colonel Forster) tried its cultivation experimentally in the public garden, where it thrived very well and produced a good crop. It requires a fair share of irrigation, and there is no doubt it would grow well enough and be sufficiently productive on canal-irrigated land, but it will not otherwise flourish.

Unknown in the Jullundur Division, except to Mr. J. W. Wright, C. E. Executive Engineer, Military Works, Jullundur Division, who in 1865 tried the following experiment:—Half a seer of nuts was sown on a plot of 400 square feet about the end of April, and germinated freely. The crop was dug up in Janu-

ary 1866, and the out-turn was five seers of fine nuts; half a seer of nuts was kept for seed and sown again in the spring of 1866, and the result was about the same; but the nuts were not quite so full and large. Half a seer was kept and sown in the spring of 1867, but the nuts failed to germinate. The nut requires a light sandy soil, and, so far as Mr. Wright's experience goes, much irrigation is not necessary. The surface of the soil should not be allowed to become a hard crust, as it prevents the plants from sending down the nut-bearing shoots from the runners which are thrown out during the rains. Just before the rains a small quantity of manure was sprinkled over the plot after it had been broken up. The nut will thrive best in a moist climate, and Mr. Wright doubts much whether the Punjab is well suited for it. It would be asy to try it on some of the sandy patches in Jullundur, trusting to the natural moisture of the ground, and also a second lot near wells where water can be had when required, and then note results. When the crop is dug up the old plants should be destroyed and a fresh piece of ground selected for the next year's crop.

In *Sialkot* an experiment was tried in the public gardens some three years ago, and "the produce of a small plot of ground was sufficient to indicate that the cultivation would be remunerative." The Deputy Commissioner suggests that the sandy and fertile soil of the "Bajwat" tract in that district would probably be a suitable place for experiment.

Unknown in *Sirsa*, and according to the Deputy Commissioner, unlikely to succeed there; but Mr. Wakefield, a former Deputy Commissioner of the district, now at Ludhiana, states that he grew it at Sirsa in his own garden, and he proposes to try it in Ludhiana.

Dr. Henderson, Civil Surgeon of Rawul Pindee, says that in Lahore the plant succeeded well on sandy soil, but failed on clayey soil.

The Financial Commissioner says that the manufacture of oil from this nut does not seem to be known in any part of the Punjab. The nut, where it is known at all, is eaten in small quantities as food, and probably only as a luxury; and it cannot be determined whether the cultivation of the plant for the sake of the oil or for export to Europe would be remunerative, until experiments on a larger scale have been undertaken. With this view the Financial Commissioner thinks it would be useful to ascertain whether nuts produced in the dry climates of the Punjab will yield the same proportion of oil as in the moister parts of India where the cultivation is better known. He suggests that seed be procured for further experiment. The Lieutenant-Governor seems to think experiment unnecessary, because the plant apparently requires a higher temperature than that of the Punjab.

5. FROM THE CENTRAL PROVINCES.

Here, as in the Punjab, the plant is grown to but a small extent for food, and not for the extraction of oil. The divisional officers report as follows:

Nagpur.—Not cultivated at all in the Chánda, Bálághát, and Upper Godavery districts and scarcely at all in Bhandára; to a limited extent in the Wardha and Nágpur districts; but the necessity for irrigation on the one hand, and the limited demand on the other, prevent its cultivation from being more general.

Jubbulpore.—The people understand its cultivation better than in Nágpur, and it is therefore more general; but there is no exportation, and it is only used as an edible luxury.

Nerbudda.—Not cultivated at all in Narsinghpur, and but little in Hoshangabad, Betúl, and Chhindwára. Nimar is the only district in which there is really any regular though very limited cultivation of the plant. Consumption chiefly local, and but little export to the neighbouring district of Hoshangabad.

Ohhattisgurh.—Quite unknown except in the Bilaspur district, where it was introduced by a Máhratta gardener, who uses the seed only in the preparation of sweetmeats.

It seems to be generally believed that soil suitable for its production would be easily obtainable in the Central Provinces, but the demand must rise considerably before it will be possible to extend cultivation to any appreciable degree.

6. FROM BRITISH BURMA.

Grown to a very limited extent; seed used as food, and no oil extracted; cultivated almost exclusively by Shans, who seem to have introduced it into the province.

7. FROM ASSAM.

No cultivation of the plant, nor any trade in or consumption of the nut or its oil to any appreciable extent in Assam; doubtful whether any artificial encouragement of its introduction would be successful.

8. FROM BERAR.

Amraoti.—1,300 acres cultivated in the district last year (187 -7). The nut is eaten by the people, and a small quantity was exported to the Bombay Presidency. Oil is not extracted from the nut. The soil of the district is said to be quite unsuitable for its growth, and the ravages caused by pigs, combined with the scanty yield, is against the extension of its cultivation.

Ellichpur.—Practically unknown. A few mális are said to have raised a small quantity, but the cultivation is so limited that it has not been separately recorded in the returns.

Wán.—About 259 acres in one taluka were sown with the nut last year, the yield from which is said to have been at the rate of 800 lbs. per acre. It was sold at 13 seers per rupee, the receipts per acre being thus Rs. 30-12; cost of cultivation not mentioned. The nut is eaten, not used for extraction of oil.

Akola.—Cultivated in only two talukas; area last year 190 acres. Nut generally eaten by Hindus on fast days, and nowhere used for making oil. The Deputy Commissioner does not think its cultivation could be increased, as other crops are more profitable.

Buldana.—1,111 acres were cultivated with the nut; eaten by Hindus on fast days, and no oil extracted.

Bassim.—Cultivation so limited that the area under it has not been separately shewn.

The Resident thinks the cultivation of the plant not capable of much extension in Berar. It is culturable only as a garden crop, and garden cultivation being comparatively limited, this alone acts as a check upon the extended cultivation of the nut. He feels confident from his own experience that where the ground-nut thrives, as in Mysore and other places, it may be turned to most useful and profitable account. The oil extracted from it is good, and realises a price which repays production, while the refuse forms an excellent cake for feeding cows and fattening cattle and sheep for market.

9. FROM AJMERE.

Not grown; was once grown in two or three biswas of well land in the village of Rāmsar, and the out-turn was about 13 seers.

10. FROM MADRAS.

The Board of Revenue, reviewing the replies of the Collectors of the Districts state, that the cultivation of the ground-nut is on the whole very limited, the total area cultivated with crop in Fasli 1269 (*i.e.*, 1876-77) being only about 34,632 acres, out of an area of 19 millions of acres under crop in that year in the Madras Presidency. Loose sandy soil in the vicinity of the sea or alluvial soils on the side of rivers are stated to be best suited for the growth of the plant.

The nut is not generally consumed as an article of food, but the kernel is fried and eaten by the poor, especially by children, more as a luxury than as an article of ordinary diet. The oil is used for lamps, giving a bright light, free from smell and smoke, and sometimes for cooking purposes. In France it passes as olive oil. The cake is given to cattle, and also used as a manure.

The following figures are available as illustrating the exports of the seed and oil, both foreign and coastwise, in the districts of the Presidency:—

	1873-74.		1874-75.		1875-76.		1876-77.		1877-78.	
	Seed.	Oil.	Seed.	Oil.	Seed.	Oil.	Seed.	Oil.	Seed.	Oil.
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
Madras	6,446	5,076	525	14,167	4,162	18,215	7,180	20,387	..	1,149
Godavari .. ..	..	61	..	286	..	205	..	594	..	..
Nellore .. ..	..	5	..	..	..	..	..	..	..	..
Kistna .. ..	..	..	..	801	..	..	..	..	..	..
Tanjore	216	20	126	4	178	86	194	40	25	..
Madura	16	..	8	23	18	..	720	..	..	..
South Canara ..	31	..	64	..	48	..	3	..	7	..
Malabar	59	941	12	187	58	..	..	..	..	..
South Arcot ..	..	..	..	..	..	50	68	23,518	..	..
Total	6,468	6,103	735	15,468	4,464	18,506	8,110	44,539	82	1,149

In 1876-77, the exports by land from South Arcot to Pondicherry were, seed 29,700 cwt., and oil 20,502 cwt. The areas under cultivation in Tanjore and South Arcot, where there are French settlements, average 5,413 and 25,000 acres respectively, yielding a produce of 41,802 cwt. and 258,750 cwt. respectively. The cultivation of the nut is well known in the Presidency, and increase of production will follow any increased demands.

11. FROM MYSORE.

Cultivation almost wholly limited to the Bangalore and Kolar districts of the Nundydroog division.

In the Bangalore district the statistics for 1873-74 to 1877-78 shew that the average area annually under cultivation with the nut was 3,540 acres, with an out-turn of about 3,131 tons, of which about 1,149 tons were exported. Of the remainder, 1,085 tons were retained for consumption, and about 897 tons used for extraction of the oil.

In the Kolar district the area under cultivation annually is stated to be 1,054 acres, yielding about 1,640 tons; the greater portion of this quantity, *viz.*, 1,190 tons, was consumed locally as food, and the remainder 450 tons used for the extraction of oil. It does not appear that any portion of the product is exported, but the Chief Commissioner apprehends that the information supplied on this point is deficient.

The nut is cultivated to a small extent in the Tumkur District of the Nundydroog Division, and in the Chitaldroog District of the Nagar Division.

The Chief Commissioner states that from the fact that the nut is chiefly cultivated in the Nundydroog Division, it may be inferred that its value as an article of export has been to some extent recognised in the districts adjacent to Bangalore, and its cultivation and use otherwise than as an article of consumption may be expected in course of time to develop and extend further into the interior. The progress already made may be estimated by the fact that prior to the assumption of the British rule in the province the extraction of oil from the ground-nut had been prohibited, and in 1860 Sir Mark Cubbon deemed it necessary to issue a notification formally cancelling that interdict, and pointing out to the people the advantages of employing the oil as an article of trade.

The plant is ordinarily cultivated as an alternative crop on land watered by wells; it is put down during the first rains in April to June, and harvested in January or February following. The leaves are used to enrich the soil for the cultivation of sugarcane and other crops, which are considered more productive.

From the information furnished by the provincial authorities, it would seem that the total recorded area under cultivation with this plant in all India is about 112,000 acres, exclusively in the Madras and Bombay Presidencies, Berar, and Mysore. In the

Bombay Presidency, the area (70,350 acres) is more than double that of Madras (34,630 acres), although such exportation as there is from British India to foreign countries is confined to the latter Presidency. Elsewhere, the nut is cultivated for food or for conversion into oil, in both cases for local consumption. The plants like a light sandy soil and a considerable amount of water, with a tolerably equable, sub-tropical temperature, and these requirements may be supplied in many parts of the littoral of the Bombay and Madras Presidencies, the eastern districts of Bengal, and the Burman coast. The cultivation is very profitable and the demand, which is mostly for France, is large. In 1878, the imports into France of "*Arachides et noix de touloucouna*" amounted to 111,443,366 kilogrammes, valued at 30,239,602 francs. Of this quantity, upward on 103,000,000 kilogrammes were imported from the western coast of Africa, where the negroes have found the cultivation an uncommonly profitable investment. Our exports of the seed from British India in the official year 1878-79 amounted to only 25,472 cwt. (1,294,402 kilogrammes), or little more than 1 per cent. of the imports into France. The question now is whether India should be content to leave France to draw all her supplies of this valuable food-stuff and commercial product from Africa, or whether she should not enter actively into competition for, at any rate, a substantial portion of the trade. The cultivation is no novelty requiring the removal of prejudices and other obstacles for its introduction. The plant is well known and appreciated by the people, and in some places the cultivation is already not insignificant and there is abundant room for development. Cultivators would assuredly respond without delay or difficulty to any call made upon them for an increased production, but they can hardly be expected to undertake any considerable risk by largely increasing the area under the plant without first having an assured demand for the produce. It is for merchants to make this demand, and I think their attention should be drawn to the subject, and that it should be suggested to them that they might with advantage enter into relations with importers of this oilseed at Marseilles, in view to a considerable augmentation of the supplies from India.

It will not be out of place to add here that the ground-nut is a valuable food-stuff, the consumption of which in India might with advantage to the people be greatly increased. I extract the following remarks on the subject of the value of the articles as a food from that useful publication, *Tropical Agriculture*, by Mr. P. L. Simmonds, London, 1877:—

"Dr. Muter after giving the following analysis of ground-nut meal, urges its more general use as an important article of food:—

Moisture	...	...	...	9.6
Fatty matter	...	...	...	11.8
Nitrogenous compounds (flesh formers)	...	...	...	31.9
Sugar, starch, &c.	...	...	...	37.8
Fibre	...	...	...	4.3
Ash	...	...	...	4.6

"From this analysis it is evident," he observes, "that the residue from them, after the expression of the oil, far exceeds that of peas, and is even richer than lentils in flesh-forming constituents, while it contains more fat and more phosphoric acid than either of them. On these grounds, we are justified in urging the adoption of the ground-nut meal as a source of food, it being superior in richness of all important constituents to any other vegetable products of a similar nature. Although in the raw state it possesses a somewhat harsh odour, similar to that of lentils, this flavour entirely passes off in cooking, and when properly prepared it has a very agreeable flavour."

J. E. O'CONOR.

Calcutta, June 16, 1879.

THE CAROB.

(Translated from the Italian ; by J. F. DUTHIE, B.A., F.L.S.)

BOTANISTS call this plant *Ceratonia siliqua*, L. It has also been named *Siliqua arbor*, *Cæsalp.* (*Siliqua dulcis* in medicine.) The Italian names are *Baccelli dolci*, *Baccelli rgeci*, *Caroba*, *Caruba*, *Carrubio*, *Carobola*, *Garrubo*, *Gnainella*, *Siliqua dolce Carata*.....

By the Arabs it is known as *Kharriḍ*, and the seeds *Kharabos*; by the Germans *Bochshörnlein*, and the pods *Johannisbrod*; by the English it is known as the *Carob-tree*, and the fruit is called *St. John's bread*.*

The carob belongs to the family Leguminosæ, and to Linnaeus' class Polygamia; that is, on the same plant there are unisexual and hermaphrodite flowers, but not unfrequently individual trees are found which bear only male flowers, and hence they are sterile, so also there are some which bear only female flowers, and they are fertile. This tree is much branched, increasing more in breadth than in height. It is an evergreen. The leaves are compound, equally pinnate, and the leaflets are of a sombre green tint, shining and entire. The flowers are small and arranged in racemes, and the fruit is an indehiscent legume, linear compressed, about 4 to 8 inches in length, and from about $\frac{3}{4}$ to $1\frac{1}{4}$ inch broad; it abounds in a saccharine pulp.

*Also the *Locust-bean*; it is sold by many grocers in England under this name.

The carob has few varieties, (1) *Carrubo Franco*, with short thin fruit curved and acuminate. It is common in Spain and Portugal, and ripens early. (2) *Carrubo mascolino* (*Ceratonia vulgaris*, Risso). The fruit of this variety is good for animals and is the commonest kind. (3) *Carrubo feminello*, *Zuccherino* or *Cannamele*, (*Ceratonia Siliqua latissima*, Risso) bears a small quantity of pods, but they are large and long and with sweet pulp, they are consequently eaten in preference by men.

The wild carob is generally sterile, and among the varieties here is a preponderance of male individuals; they can however be utilized for grafting fruit-bearing individuals on.

The seedling carob in favourable conditions becomes a fine tree, with a large and symmetrical head. It is not a tall tree, but its branches are arranged with regularity. With little care the plant acquires a handsome appearance. The soil becomes filled with an intricate network of its roots, which often renders difficult the cultivation of other plants. The carob is generally reproduced by seed, as it is very difficult to make cuttings succeed. Before the seeds are sown they are treated as follows: in the spring the seeds are picked out of the pods, and immediately put into water where they remain for 3 or 4 days, care being taken to renew every day the water in which they are soaking. When the seeds have swelled they are sown in the ground, that is in the place where the plant is to remain, but oftener in a piece of ground which has been well worked and manured, and called a nursery. In the latter case the ground which has been prepared to receive the seeds is watered, inundation being preferred, it is then left to dry as long as to allow without difficulty holes to be dug at a distance of about 20 inches, in which are placed the seeds 5 in each hole. The seeds are lightly sprinkled with earth, and the nursery is made. If the temperature remains favourable, after 8 or 10 days the seedlings will show themselves. Being satisfied that the seeds have all germinated, and as soon as it is convenient, the seedlings are transplanted, taking care

to leave in each hole the strongest-looking and best rooted plant. By sowing the seeds in groups of 4 or 5, one has the advantage of selecting and tending the best seedlings, and you are sure not to see in the nursery empty spaces as would occur were the seeds sown singly in each hole in consequence of any failing to germinate. It is necessary to thin out the seedlings in the nursery, otherwise they would suffer by growing up in bunches of 3, 4 and 5.

The seed of the carob gives rise to a plant which may be hermaphrodite, that is having both male and female organs in the same flower, or it may turn out to be monœcious, diœcious, or polygamous. To ensure the fruitfulness of all the plants, it is necessary to graft them, and this is done when they are still in the nursery and have reached the height of about 2 feet. The scions must be those from a fruit-bearing tree, and the two methods of grafting, preferred before all other kinds, are budding and stem.

Having finished the grafting of the plants in the nursery, they remain until their stems attain a diameter of about $\frac{1}{2}$ inch before transplanting them into the plantation. This removal from the nursery to the plantation must be undertaken whilst the plants are still young, it being indispensable for the success of the plants that they be moved with a large ball of earth and with as large a quantity of roots as possible. As the plants become older, they are less manageable, and the operation becomes more difficult. Transplanting is one of those operations which requires to be undertaken with the greatest care and precision; on it depends the future welfare of the plants: such precaution therefore will not be superfluous.

In order to facilitate transplantation, it is advisable to water the ground thoroughly so as to ensure having a large ball of earth from 8 to 11 inches in diameter. The plants should be put into the plantation at the distance of about $3\frac{1}{2}$ feet. The next treatment required for the plants is to render the soil fine clean, and friable, and in places where the severity is likely to

injure the plants they must be covered if they are still small, and if large the stems should be bound round with straw and the lateral branches cut away.

At the age of 4 or 5 years the plants are transplanted from the plantation to their permanent place, and they are put in at the same depth as they were in the plantation. In carrying out this second transplanting, the same care must be exercised as in the first. It may be undertaken during the summer, but at this season it is advisable to water the plants thoroughly; in the autumn it can be done with less watering. Carob trees require to be placed at a distance of say 15 yards, since the roots occupy as much space as the branches.

From the earliest age of the plant endeavours should be made by means of pruning to form a head composed of 4 branches. This done, it will be sufficient to remove suckers, and to make a few slight clippings, as it is a tree which becomes much crowded with branches. When the tree has advanced in years, the upper branches die off; at this time a vigorous pruning up to the healthy parts will restore the plant to good condition. The dead trees must not be replaced before the ground is cleared of the roots of the dead plant.

In the neighbourhood of Naples, and especially on the spurs of Mount Vesuvius, the carob is abundantly cultivated and with much profit; but the system of cultivation in these parts differs considerably, if not entirely, from what has been described above, and seems to be preferable from its simplicity and the saving of time. The cultivators of the Vesuvian campagna are not in favour of nurseries and plantations. They maintain that transplanting kills the young plants. Considering the nature of their climate and soil they are perhaps right, and the more so since they have found the system they have hitherto followed to be the best.

In February they sow the seed in little earthenware pots, one seed in each. As soon as germination has commenced, they bury the pot in the spot where they wish the plant to

grow and remain permanently. During the summer they water them, but they cannot always provide sufficient water, in which case they cover the young plants with leaves or branches. The root, as it grows, breaks the pot, and the plant may be considered secured.

They say that seedlings from seed of the cultivated plants need not be grafted, but if required, they wait until the plant is four or five years old and bud, or graft on to it towards the end of May.

This plan is to be recommended, both on account of the very small cost incurred in raising the plants and for the certainty of their success; but it cannot be said to tend to hasten the fruiting of such plants. Plants raised on this system remain for nine or ten years before they first give fruit; whereas those which have passed through the nursery and plantation are in fruit after two or three years.

It is not an uncommon circumstance to see seedlings under the trees which have given fruit; it evidently proves that the seeds have fallen naturally on to the soil. If proper attention in the way of watering and transplanting be given to these seedlings, trees may be obtained which will differ in no respect from those raised according to the other method.

In order to derive profit from self-sown carob trees which are somewhat aged, or which have given no fruit, or it may be only a small quantity and of inferior quality, it is recommended to graft on to them. If it is a male tree that is to be operated upon, a large number of its branches should be grafted with female shoots; if however the tree is a female, it will be sufficient to graft only a small number of its branches with male shoots. In any case it is only the young healthy branches that should be grafted upon. Should the grafting on the adult plant succeed, it will give fruit after four or five years.

The carob flowers in July and August, and the fruit does not ripen until the succeeding autumn. The flowers are generally borne on the older branches, and sometimes they appear even on the main trunk.

The fruit which is at first green changes afterwards to a reddish brown colour. The appearance of this colour, together with the spontaneous falling of some of the pods, is a sign that the proper time has arrived for gathering the fruit; this occurs generally in the month of September. The operation is a very simple one. The pods are collected by hand, or when this is not possible they are beaten down with a pole. When gathered the pods are spread out on the floors of dry and well-ventilated rooms, or laid in alternate layers with straw. They must not be collected into heaps, otherwise they will ferment and turn black. They must quickly be made use of, or they will fall to pieces, become white, and worm-eaten.

Climate.—The cultivation of the carob has a northern limit beyond which its existence is rendered critical by the cold of winter. It may be said with tolerable accuracy that the carob occupies the region of the orange, that is to say, where the orange can grow without artificial protection during the winter. It has been stated that the carob grows in the same climate, as that of the olive, enjoying therefore a climate more northern than that of oranges and such fruits. We believe that this opinion is not accurate. Thus, for a great distance along the Abruzzi coast, the olive and the orange are cultivated with much profit, and the carob also thrives well. At a few thousand feet above the sea however it is found, in spite of numerous trials, that the orange and carob cannot exist; whilst the olive can be cultivated with advantage even to the foot of the Majella. Lastly, in Lazio, in Umbria, in Tuscany, and in some parts of northern Italy where the olive grows, neither the carob nor oranges are cultivated. In Italy it can only be profitably cultivated in the true orange zone, preferring the lower parts of sunny slopes.

Soil.—The requirements of the carob regarding climate are amply made up for by the ease with which it adapts itself to all kinds of soils provided they are dry. It thrives well on stony ground and on limestone rocks, as, for instance, near

Gaeta and Amalfi, also on the clay soil along the Jonio Coast, as well as on the volcanic lava of Mount Vesuvius and Etna. Large carobs may be seen on cliffs and rocks with scarcely a handful of soil to nourish them. Marshy and damp soils are the only ones where the carob will not prosper. It will of course grow better in rich, deep, and friable soils, and attains to an immense size, occupying often an area of several hundred square feet. It is marvellous, the rapidity with which the plant grows in good soil, and when the climate is favourable. In one year the young plant may measure several centimetres in girth and two or three metres * in height. Carob plants resist admirably the dryness of prolonged droughts, and whilst the olive droops and other plants die during the excessive heat, the carob seems to be unaffected; notwithstanding this it is benefited by irrigation, but this operation should be conducted with great judgment, and special care should be taken to allow the water quickly to drain away, and not remain near the plant.

Manure.—It is needless to say that the carob like all other plants is benefited by manure, though the cultivators in the neighbourhood of Mount Vesuvius maintain that it is of no use; nay, on the contrary, that it does them harm, "it will burn them up," as they say. They compare the Carob with the Prickly Pear, a plant which, although so distinct, yet resembles it as regards its requirements in the matter of climate and soil. Now, according to these cultivators, if the plants are placed under the same conditions, the latter, that is the Prickly Pear, requires manure, and prefers liquid manure; the carob on the contrary suffers by its application and becomes gorged. They have found it however of some use to dig a trench during the summer all round the trunk of the carob in which they bury some fresh grass. We cannot say how much weight should be given to the assertions of these people. Surely the small quantity of grass which they bury is too insignificant to serve as manure for the carob; perhaps the fact of removing a

* A metre equals about 3¼ feet.

small quantity of earth, and the moisture communicated by the grass may be of some slight benefit to the plant. A very rational explanation of this result, and perhaps the only true one, may be found in the extreme fertility of the soil which is volcanic. Considering these special conditions and many others which are favourable to the plant, we could not generally recommend to cultivators of the carob the practice hitherto adopted by the cultivators in Mount Vesuvius.

In Puglia and such places where the cultivation of the carob is more frequent, manure is given to the plant with great advantage. The manure commonly used is a mixture of dung and green plants; seaweeds cast by the waves are preferred in districts near the coast.

Association.—In regard to the association of the carob and other plants, it is convenient to make a distinction between a plantation in which the trees are massed indiscriminately, as may be seen on the spurs of Vesuvius, and where the climate is comparatively cold, and in the case of one in which the trees are regularly arranged and the climate is hot. In the former case the thick shade of the trees impedes the well-being of any other cultivated plants unless the cultivators are willing to suffer loss by reducing the number of carob trees. In the case of the latter plan, when the plants are arranged in regular lines and in a hot climate, their shade is useful for keeping the soil cool. You can then grow rye, wheat, rice, and other cultivated plants alongside the carob. In the district of Torre-del-Greco, we happened to see under the carob trees sufficient grass to be cut with a scythe, or that could be ploughed in as manure, and the lupine was growing to a marvellous size. There would be room for vines also between the rows of the carob were the latter arranged with any sort of order.

Diseases.—It may be said that as yet the carob has not been affected by any disease. In common with most cultivated plants, however, it is attacked occasionally by aphides

called "pidocchi," but the limited number of these insects and the ease with which they are destroyed, renders the disease, if such it can be called, of little or no importance.

The remedies against such animals are very simple and easy to apply. Should they have obtained a footing on the small branches of the plant, it is better to cut off these branches and burn them. If, however, they have encroached more extensively, it is necessary to destroy the animals by brushing the leaves one by one. In the latter case it is also found useful to throw sand over the plant from top to bottom several times. The fruit of the carob is attacked by a kind of butterfly "*tignuola*," which, in the larva state, penetrates the fruit and destroys it; sometimes the damage done by this insect is serious. Entire heaps of carob beans are found to be so worm-eaten and full of maggots, that horses and other domesticated animals refuse to eat them.

To guard also against these insects, the remedies are simple and certain. They will hardly show themselves in the store-house, but before they have time to lay their eggs, some means must be sought for their destruction. The fumes of sulphur anhydride, resulting from the combustion of sulphur, are known to be suitable for the purpose. If this chemical operation is assisted by mechanical means and the corners and walls of the store-rooms are kept perfectly clean, the fruit may be kept free from harm for another year.

Produce.—The carob begins to give fruit more or less early according to the treatment it has undergone in the early stages of growth, but never later than the tenth year. The produce increases year by year as the tree grows, up to a period of about 30 years. One must take care however to allow, for, as in the case of many other kinds of fruit trees, "*uno pieno et uno vuoto*," as the saying is. It is certain that an adult tree in healthy condition and in favourable years will give as much as 10 quintals* of fruit; in average

* A quintal is equal to two hundred weight nearly.

years one may calculate upon 4 or 5 quintals. The price of the fruit in ordinary years is from 8 to 10 lire per quintal; this year they have been sold for as much as 15 lire.

Profit.—The produce of the carob is considerable; the plants grow however under conditions so diverse that the out-turn can only be given approximately. It is difficult to give any estimate regarding its cultivation in Italy, as it is not anywhere carried out systematically and on a large scale.

Fleury, the French Consul at Valenza, has made a computation, but it rests on data which are very vague and not much to be depended upon.

He supposes a field covered with carob trees worth 2,500 liras, and calculates the produce of each year as follows:—

6,300 kil. of fruit at	
the average price of	
6 lire per quintal =	L 378
Cost of cultivation =	„ 78
„ „ collecting =	„ 50

Nett income ... L 250

The ground valued at 2,500 lire would give then 10 per cent. profit.

As we have said the data on which this calculation is based are vague; indeed, nothing is known as to the age and the number of the plants, the area of the ground, or regarding the quality or quantity produced by plants of various ages.

Decandolle alludes to a calculation made by the cultivators in the neighbourhood of Nice and Monaco. They estimate the crop of the average tree to be 100 kil. of fruit, and that 4 trees on a hectare (= nearly $2\frac{1}{2}$ acres) will give 4,400 kil., that is, at the rate of £ 0-10 per kil, they will bring in 440

lires.* Others say, perhaps with a little exaggeration, that a large and well-cultivated tree can produce fruit to the value of 150 lires, and that a hectare of ground covered with trees ought to yield as much as 5,000 lires every two years. This much we can guarantee without fear of being found to have outstepped the truth, and that is in the territory of Torre-del-Greco. During the present year a carob tree has given nine quintals of fruit, which were sold on the spot for 15 lires per quintal. To cultivate the carob, so that its yield of fruit in relation to cost may become a source of profit, steps should be taken to utilize rocky and comparatively sterile ground.

In Sicily the cultivation of the carob is left to nature, whereas formerly it was not so neglected, and its fruit used to constitute an important item in the food of the inhabitants. But it appears that the introduction of the Prickly Pear, and the great use made of its fruit, as well as the ease and rapidity with which it grows, have caused the carob to be neglected. Notwithstanding this, enormous quantities are exported from Sicily. In Sardinia and Corsica and at several places on our coast the carob would be a great acquisition.

It is with great pleasure that we watch the interest taken by the inhabitants of the Amalfi Coast in advancing the cultivation of this hitherto neglected plant. When visiting this neighbourhood we had the opportunity of observing large plots of ground ploughed and intended exclusively for carob cultivation. The cultivators say that from the day on which they substituted the carob plantation for the olive grove their prosperity commences. They have in fact become doubtful whether the cultivation of lemons is more profitable than that of the carob.

Uses.—The countries in which the carob is found and where

* DECANDOLLE *Memoires de la Société Royale et centrale d'agriculture* 1840, p. 235.

it is more or less cultivated are the coast of Portugal and Spain, the Balearic Islands, the Southern Coast of France, the whole of Western Italy, and eastwards beginning from Elba, Corsica, Sardinia, and Sicily to the Islands of Lissa and Lesina off Dalmatia, Zante, Corfu, and Cephalonia, Greece, and the Archipelago Islands; also the Byzantine country, Asia Minor, North Africa, where it would appear that Morocco marks its southern limit, whilst Genoa is the limit of its north extension.* I have not been able to ascertain whether it has also been found in the Island of Madeira, the Canaries, or the Cape-de-Verd Islands.

At Valenza the chocolate-makers introduce the flour of the carob into a cheap kind of chocolate.

The druggists prepare decoctions which are frequently used in cases of cold in the chest and generally in combination with dried figs. It is employed also as a mild laxative like the tamarind. The juice of Calabrian liquorice contains the pulp of carobs. The Arabs use it instead of sugar in the preparation of confectionary, and from it they extract by means of fermentation and distillation a kind of spirit.

The carob is used as an article of food for men, but especially for domesticated animals. In Barbary the pulp of this fruit is mixed with barley and wheat flour, and made into bread. But the carob is much more important as a food for animals, especially in hot dry climates like those situated on the southern coast of the Mediterranean where ordinary forage plants are deficient. Carob pods are eagerly devoured by pigs, whilst horses, mules, donkeys, cows and sheep voluntarily eat them.

In places where straw has to be given as food during the winter, it would be very advantageous to add some pounded carob pods.

Ottavi, in his "*Agricoltura Meridionale*," says that a hectare of carob trees would give a much larger return, and a more certain one than that of the better kinds of forage; being

* Kotschy has found it in the island of Cyprus at an elevation of 2,000 feet (*Fl. Orient. Boissier*, Vol. ii., p. 632).

a tree it can resist better than a herb the scorching heat of summer.....

The bark of the carob is employed medicinally. An extract is made of it which is administered in doses of 30 to 50 cent. in cases of diarrhoea. The wood is very good for building purposes, and also takes a good polish. Carobs are an important constituent in the manufacture of artificial essence of pine-apple which is much used in confectionary. This essence is indeed manufactured chiefly from butyrate of ethyl, which is obtained by the combination of alcohol and butyric acid, and this latter is found in a free state in carob beans. The following methods for obtaining butyrate of ethyl from the fruit of *Ceratonia* may be briefly indicated. There are two methods, the one in which the butyric acid only is extracted, the other by which not only is the existing butyric acid utilized, but a portion of the sugar is converted into butyric acid.

Stinde says that carob beans, which can be obtained at a moderate price, contain the acid already formed in such quantity, that by pulverising them, seeds and all, and dissolving them in water made slightly acid with sulphuric acid, the liquid resulting from distillation will contain from 2 to 3 per cent. of hydrated butyric acid.

Reinsch observing that the carob contains a large quantity of sugar accompanied with a peculiar ferment capable of inducing the butyric fermentation of the saccharine substance, if prolonged for a sufficiently long period, has discovered a method of preparing butyric acid in larger quantities than by Stinde's method.

Fifty kil. of carobs are reduced to powder and thrown into a vat standing in a warm place, such as in the vicinity of a boiler, or a baker's oven; water at the temperature of 20° C. is poured over them, sufficient to form a smooth paste. After 4 or 5 days 12 kil. of powdered marble or chalk are added; it is then left to ferment. From time to time as the substance

becomes denser it is necessary to stir it, adding, when required more warm water in order to prevent its thickening too much. After a week's time, if done during the summer, the fermentation is complete ; during this time the sugar of the carob has been converted into butyric acid and butyrate of lime by the action of the acid in the carbonate of lime. The substance containing the butyrate of lime is transferred from the vat in which the fermentation took place into a large copper vessel furnished with double walls between which steam should be allowed to circulate. On the evening preceding the day on which the distillation is to take place, a mixture of 18 kil. of sulphuric acid of commerce, and 60 kil. of alcohol at 95 is prepared, and on the following morning it is thrown over the paste in the copper vessel, stirring it all the time with a stick until the acid and the alcohol are thoroughly mixed with the paste. At this stage the vessel must be covered and hermetically sealed, and steam is allowed to enter between the two walls of the vessel, the distillation will commence immediately, and as soon as the distilled liquid begins to fall in a continuous stream, the quantity of steam should be diminished. The first 500 grains of the distilled liquid should be collected separately, and the operation continued until the product falls only in drops. The portion of butyric acid not drawn off by this process is left to digest with a solution of chloride of lime. The stratum of ether is drawn off by means of a funnel and stop cock, or by any other convenient way, and is rectified over magnesia, in small quantities inside a glass retort. Stinde remarks that in the case of butyric fermentation, when old cheese or meat is used as a ferment, the carob is to be preferred to the sugar of fecula to sugarcane and to starch, because in the case of these latter the fermentation process demands too much time, and variations of temperature occur which give rise to secondary products.

Stinde also expresses a doubt whether from the butyric acid produced by any other method, an ether can be obtained,

which possesses that delicacy and fragrance required by manufacturers of confectionary.

In every case when carobs are employed for the operation above described, it is important to see that the pods are free from mould and not worm-eaten, for were this the case the butyric ether will have a disagreeable smell and taste.*

In the province of Naples the carob forms a large proportion of the food of hired horses, and of beasts of burden generally.

NOTE.

The information contained in the above account of carob cultivation in Italy is worthy of considerable attention by those who are undertaking to extend its cultivation in this country. The results of experiments already made show clearly enough that the climate of certain parts of Northern India is favourable to its growth as a tree, and steps should now be taken to increase the yield of the fruit, as well as to improve its quality. I have not heard that any attempt has been made in India to propagate the plant by grafting. This operation, which is considered by the best cultivators in Italy to be essential to the production of good fruit, could easily be carried out under careful superintendence, and the grafts when ready distributed in the ordinary way. It would hardly be possible, nor indeed would it be necessary to have every plant grafted; for seedlings, unless of the male sex, are capable of yielding a large amount of fruit of very fair quality, especially if the seeds are obtained from good fruiting varieties. These seedling trees might also be utilized as shade-trees for roadsides or formed into *baghs*. The carob is an evergreen, and if properly cared for, will grow into a large handsome tree. The climate of N.-W. India, as far as temperature is concerned, would appear to be all that is needed for the welfare of this tree. It remains however to be observed to what extent the soaking condition of the ground, during the rainy season, is likely to affect it. In any case endeavours should be made to plant the trees, whenever it is possible, on rocky ground, or where the soil is well drained. Such conditions exist over large tracts of country, both in the N.-W. Provinces as well as in the Punjab along the lower slopes of the Himalayas. Supplies of seed and grafts are shortly expected to arrive at Saharanpur; these, with the trees which already exist in the Botanical Garden, will form sufficient material for commencing operations in accordance with the methods recommended in the above paper. The author of this article has, I understand, recently published as a sequel some observations regarding the application of carobs as food for horses.

J. F. D.

* These notes on the extraction of butyric ether from carobs are taken from the *Encyclopædia Chimica Italiana* of Signor Selmi, and the other portion of the paper from *Agricoltura Meridionale*, by Doctor T. Simonetti, republished in *Bullettino della R. Società Toscana di Orticultura*, July 1879, p. 218, and concluded in the August number, p. 227.

*Further particulars regarding the cultivation of the Manilla
Hemp plant in the Andamans.*

(Communicated by the GOVERNMENT OF INDIA.)

WITH reference to your letter No. 151 of the 14th July and its annexures, I have the honor to report that one plant only of *Musa textilis* was received here in 1873, and was put down in the Dover Gardens. From this about 20 plants were propagated, and these were cut down in March last for conversion into Manilla hemp, from which the sample that has been so favorably reported on by the Agri.-Horticultural Society was taken.

2. As the plants did not appear to thrive in the Dover Gardens, they were removed at the commencement of the rains and planted out at Shore Point, on land recently reclaimed from forest, which is largely impregnated with decayed vegetable matter.

3. The present plantation only comprises 40 young plants, none of which are higher than three feet.

4. In letter No. 21 of the 10th April last from Her Britannic Majesty's Acting Consul at Manilla to your address, I notice that the plant can be grown from seed, and I think it would be advisable that some seed should be obtained from Manilla, as with the present very small plantation it would be a very long time before we could grow Manilla hemp on a large scale.

(Sd.) C. A. BARWELL, LIEUT.-GENL.,

Chief Commissioner,

27th August, 1879.

Andaman Islands.

*Note on the cultivation and manufacture of the Manilla Hemp
(Musa textilis) ; BY H. B. MAJESTY'S CONSUL at Manilla.*

(Communicated by the GOVERNMENT OF INDIA.)

I HAVE the honor to acknowledge the receipt of your despatch, No. 20 of 31st January, and have now to furnish you

with what information I have been able to procure regarding the cultivation, &c., of the *Musa textilis*, or Manila hemp plant.

The plant thrives best in soil largely impregnated with decayed vegetable matter; the district in which it is planted being, to a great extent, reclaimed forest lands. Hilly land is the most suitable, the plant yielding more abundantly on such than on low-lying flat ground.

The volcanic nature of the soil of these islands seems to be particularly suitable for its growth.

The climate should be humid, as the trees require a large amount of moisture, and the production is chiefly in the Southern districts, where the rainfall is greater. The trees suffer severely during long periods of excessive heat and drought.

The plant can be grown from seed; but the custom here, after cleaning the land thoroughly, is to plant small plants of about three feet high, leaving a space of from two to three yards between each, the young shoots which spring up later round the parent stem filling up the intervening spaces. The ground should be thoroughly cleaned and freed from weeds at least twice a year.

It takes about three years to produce a full crop. In a favourable soil, however, the first crop will be available in about two years after planting, but will only be about one-third of the full production; the second crop, the following year, will yield about two-thirds, and in the fourth year a full crop will be obtained. The trees are ready for cutting when the first stems are thrown out, and the leaves of the plant, instead of spreading out on all sides, close together. The plants must on no account be allowed to produce fruit, as they then become worthless.

When the trees have matured, or are ready for cutting, they are cut down about a-foot from the ground, and the labourer then proceeds to strip off the layers from the trunk

which are cut into strips of about three inches wide, or say, three strips to each layer. These strips are then each drawn through between a blunt knife and a board to remove the pulpy vegetable matter from the fibre, which is then spread in the sun to dry. As soon as it has been thoroughly dried, it is ready for the market. The appearance of the fibre depends entirely on the care bestowed in drying it, as, should it be exposed to rain or not thoroughly dried, it becomes discoloured, or assumes a brownish tinge, and loses the strength to some extent.

The outside layer also produces a reddish coloured fibre, which is, however, quite sound, and is easily distinguishable from the spoiled hemp.

The cost of preparing and planting a *quinon* (10,000 square fathoms) and keeping it clean up to the time of the first crop is estimated at £ 200 to £ 300, not including the original cost of the land, and afterwards an annual outlay of about £ 60, would be required to keep the soil free from weeds, &c.

The above mentioned extent of land would produce 30 to 40 *piculs* (140 lbs. English each), according to the quality of the soil, after the plantation is three years old. The labourers here receive, as a rule, one-half of the result of their work, the other half going to the owners of the trees; but owing to the low prices now ruling, they are receiving three-fifths at present and the owners two-fifths. One labourer working under pressure can clean nearly 20 lbs. of hemp per diem; but, as a rule, the quantity cleaned by one man working steadily day by day averages about 12 lbs. At the present value of hemp in the producing districts, each man's half share would be equal to about 15 cents. per diem, allowing for expense of carriage from the plantations to the shipping ports; and this being insufficient for the maintenance of the workmen and their families, the plantations are being neglected in many places, the natives taking to planting maize and other food plants.

When once planted, the trees continue to propagate themselves, sending up shoot after shoot from the old roots. A plantation will continue to give a good production, for from fifteen to twenty years, after which the soil becomes exhausted, and new land has to be planted. There appears to be little or no disease among the trees, which, it may be said, can only be injured from long continued drought or by hurricanes, the trees being remarkably tender and easily blown over.

The total production of the fibre in these islands last year was 3,25,600 bales or 40,700 tons, which is just about the estimated total consumption of the world; and with better prices, the supply could be greatly increased.

As regards machinery, several attempts have been made, but have proved unsuccessful, to invent a suitable machine for cleaning, to supersede the primitive method still in use, which consists of a few cross and upright bars of bamboo, to which are fastened the board and cleaning-knife; the fibre, or rather the layer or strips, being introduced between the board and the knife, which latter is then held down by a string attached to a cross bamboo, on which the foot of the workman is placed, and the strip is pulled through, thus removing all the vegetable matter.

The chief fault of the machinery hitherto tried has been its weight; it being absolutely necessary that it should be light enough to be easily carried about by the workmen, and its liability to break the fibre.

A new machine is just reported to have been invented, which, it is said, is likely to prove suitable; but it has not been tried here yet.

I trust the foregoing information may prove of service.

MANILLA,
10th April, 1879. }

Cultivation of Euchlæna luxurians in the North-Western Provinces and Oudh. Reported on by E. C. BUCK, Esq., Director, Department of Agriculture and Commerce.

(Communicated by the GOVERNMENT OF INDIA.)

IN continuation of my No. 253, dated 21st May, 1878, I have the honor to submit a report on the cultivation of *Euchlæna* (*Euchlæna*) *luxurians* in these Provinces during the year 1878-79.

2. The introduction of this fodder plant into these Provinces dates from the commencement of 1879, when I obtained a small packet of seed from the Agri-Horticultural Society of Calcutta. Although it could only be tried in that year on a very small scale, yet the results appeared to prove that the plant would flourish well in the plains and would give an abundant fodder crop, which was more liked by cattle and (from its sweetness) more nourishing than the usual crops grown for fodder in this country.

3. In March 1878, some more seeds were received from the Government of India, which had been received from Dr. Sheweenfourth, the African Explorer. The quantity was small but, supplemented by the seed which resulted from the cultivation of the preceding year, enabled experiments to be conducted on a larger scale.

4. Seed was distributed to the Saharanpur Botanical Gardens, the Cawnpore Experimental Farm, the Lucknow Horticultural Gardens, and the Forest Nursery Ranikhet, for careful sowing and cultivation. Some was also sent to Canal Officers for cultivation on the banks of distributaries, to the Ordnance Timber Agent Fatehgarh, and to various European officials and Native landholders who showed an interest in agricultural matters. Reports from some of these latter have not been received, nor is it considered advisable to insist in all cases on the submission of detailed information as to the result of this, or similar agricultural experiments. The trou-

ble of keeping and submitting an accurate register of results might debar this Department from the co-operation and assistance of private persons, for whose benefit the experiments themselves are intended.

5. The reports which have been received may be taken to prove that the Reana luxurians is a most successful fodder crop in the plains and on irrigated land. In the Hills (judging from the report of the Superintendent Forest Nursery, Ranikhet), it will not succeed, and it is only when plentifully watered that it grows with the luxuriance which makes it one of the most prolific of fodder crops. Under favorable conditions the plants grow to a height of over 15 feet with as many as 30 stalks from a single root. It will give three cuttings between August and November. The quantities of seed, which can be distributed were very small, in most cases not more than 1 oz. Since there is a large demand for seed, it was considered advisable to grow the plant for seed and not as a fodder crop, and there are no definite statistics of the amount of fodder produced *per acre*, since the plants were in no case systematically cut down. The return in seed was very large, the plants at Lucknow yielding 1 maund from 1 oz., or 1280 fold. The green stalks and leaves are greedily eaten by cattle and elephants.

6. During the past year sufficient seed has been raised for the cultivation of Reana during the present year on a large scale, to give definite results as to its outturn in fodder, compared with the native fodder crops.

Process of Grafting Mangoes on the tree. (Communicated by the

DIRECTOR DEPARTMENT OF AGRICULTURE AND COMMERCE,
N.-W. P.)

I beg to forward for your information a note by Mr. Phillips, Superintendent Local Gardens, Allahabad, on Mango Grafting, and request the favor of your opinion.

2. The process is only speedy and cheap and can be made to give very large number of grafts (several hundred)-from one tree in a few weeks. The question remains whether the trees produced are as strong and fertile as those produced in the ordinary way, and I shall be glad of your opinion on this point.

The process by which this is accomplished is very simple. In the first place the seedling with seed attached thereto, when it is about 6 or 8 inches high and three weeks old, is carefully lifted with a small ball of earth. The roots, with the earth intact, are then wrapped up in a little grass, and the young seedling plant tied to the tender branch of the tree required to be grafted from, care being taken that the young seedling tree and the branch to be grafted should lay pointing in the same direction, and be of the same age, *i. e.*, both seedling and graft should be of that year's growth. When grafted, the join should be covered with grafting-clay to exclude the air.

2. The roots of the seedlings, suspended as above described, when grafted, must be kept moist by watering, either by hand or with a garden syringe, in case there be not sufficient rain.

3. The process of grafting should be commenced in the beginning of the rainy season as soon as the young mango seedlings are procurable. The plants should be ready for cutting, *i. e.*, the graft should have taken well within a month; the graft should be partly severed at first and completely severed a few days afterwards; but I have succeeded in cutting them so soon as thirteen days after grafting, and the plants so removed are now in good growth in the nursery. In fact plants thus grafted in this season are now growing strongly and ready for sale. The plants grafted in this way on young wood, where the junction is so complete,

120 *Note on the Propagation of Grafting Mangoes.*

will, in all probability, be much stronger than those grafted on two or three years old plants, where the wood being hard between the grafts, such a complete union is impossible, from which cause a great number of the plants die or are broken down by the wind.

4. The following is the actual cost incurred in raising 2,000 grafted mango trees by the above method—

			Rs.	A.	P.
To digging bed and sowing seed	...	...	1	0	0
„ lifting and tying up plants for grafting	...	...	4	4	0
„ grafting 2,200 plants	...	...	5	0	0
„ Bhisti watering, one month ...	...	...	4	8	0
„ cutting and planting the young grafted trees in bed	...	...	2	8	0
„ twine for tying plants to trees	...	...	2	2	0
Total, Rs.			19	6	0

Total, say Rs. 20, equal to less than 2 pie per plant; add watering in the nursery for one year Rs. 10; the plants when ready for sale would thus cost about 3 pie per plant. Plants raised at such a trifling cost, and in such numbers, and which promise to be so hardy, should soon take the place of the common seedling mango trees on road-sides, canal banks, topes, &c.

J. PHILLIPS,

Supdt. Govt. Farm, Allahabad.

25th August, 1879.

Note by MR. JOHN SCOTT of the Royal Botanic Garden, Calcutta.

IN respect to Mr. Phillips's suggestion as to the mode of mango propagation, you are doubtless aware that the native nurserymen practise the herbaceous mode of grafting also; attaching in the seed-bed one seedling to another, and subsequently sending them to market as *grafts* of such and such varieties. I believe this is extensively practised, and I hear that the

young plants thus attached become firmly united in from three to four months. Mr. Phillip's plan is worthy a trial; only I fear each young plant would need to have the ordinary gooty just above it, to afford the roots a regular supply of moisture. Treated as Mr. Phillip's suggests (that is wrapped in a little grass), the young plant would wither and die.

*** While the above is passing through the Press, the following additional papers have been communicated by the Director, Department of Agriculture, N.-W. P.*

I HAVE the honor to acknowledge the receipt of your letter No. ^{2146A}_{CCCCXXV} dated the 30th ultimo, with enclosure regarding the process of grafting Mangoes on the tree.

This process would appear to be a modification of what is known as "Gutti" grafting, the difference being in the attachment of seedlings with the roots already developed, thus constituting a true graft.

I can see no reason to believe that plants raised in this way will not be quite as healthy, as those raised by being planted beneath the tree.

Experience alone can shew whether the former will be as fruitful as the latter, or of equal quality. Should the plan prove a success, the advantage of expeditious preparation and of economy will be very great.

I may add that Mr. Gollan shares the above opinion.

J. F. DUTHIE,
Supt. Govt. Botanical Gardens,
SAHARUNPORE.

10th October, 1879.

I HAVE the honor to acknowledge receipt of your No. ^{2353A}_{CCCCXXV} dated the 10th instant with enclosure.

The plan of inarching very young mangoe seedlings, as described by Mr. Phillips is, in my opinion a most excellent one, simple and perfectly sound in principle. There can be no doubt that the union of the young wood is most complete when inarched at this early stage; and I see no reason to suppose that mature trees will be less fertile than of inarched in the ordinary way.

WILLIAM CRAW,

Superintendent Forest Nursery,

RANIKHET.

19th November, 1879.

As requested in your No. $\frac{2145A.}{CCCCXXXV.}$ dated 30th September, 1879, I have the honor to state my opinion on the method of grafting, detailed in Mr. Phillip's note sent with your letter above quoted.

The process appears to be speedy and cheap; but the chief point is, will plants raised under this system equal those raised under the method now in vogue. I confess to having considerable doubt in the matter, and certainly would not be inclined to adopt in favor of the present method without more conclusive evidence of its superiority than at present exists. It is an established fact that young and quick growing shoots when inarched unite better and quicker than older ones, and that a better junction is effected by inarching stocks and scions three weeks old than when they have attained the same number of years, leaves no room for doubt; but the question is, how far the fruitfulness of the trees will be affected by this better or more intimate union: my opinion is that it will foster luxuriance at the expense of fruitfulness.

Ballet in his work "Budding and grafting," page 6, speaking of the mutual vigor of scions and stocks says:—"The tree will be less vigorous than if perfect harmony existed between the two parts, and its growth being thus tempered it tends more to the production of fruit."

It is also a matter of doubt with me whether or not scions severed from the parent tree before they have matured somewhat, and filled with the proper juices of the tree and formed strong healthy bark, will continue unimpaired all the true characters of the parents, should any deterioration occur, (and it seems to me quite within the reach of possibility) the object of grafting would be very considerably neutralized.

With regard to the stocks, I cannot but think that they must be greatly weakened and receive a serious check by being dug out of the ground and hung on to the branches of a tree for three weeks or a month. They may keep alive and apparently not suffer; but they cannot fail I think to be the worse from having a considerable number of their roots out of the soil, and therefore deprived of many elements of food essential to their growth, which moisture and water alone do not supply. This may seem an unimportant point, but as it closely affects the constitution and therefore future well-being of the trees, it should not be overlooked.

With regard to the age of stocks, Ballet states that "Stocks that have been planted a year at least should be employed."

M. RIDLEY,

Supt. Horticultural Garden,

1st December, 1879.

LUCKNOW.

Note on the Field or Garden-rat of the Bengal Presidency and (probably) Burma. BY H. JAMES RAINEY, ESQ.

INCREDIBLE as it may appear this species of burrowing field-rat, a well-known and destructive denizen of gardens, etc., in Bengal, has only *very recently* been accurately described and named. *In the Mammals of India,** it is confounded with a closely allied species inhabiting

* London Edition, 1874, pp. 187-190.

Southern India; namely, *Mus* (*Nesokia*) *providens*, Elliot, which has lately attracted much public attention, from the devastation it has committed in the ripening crops of those parts.* Jerdon's "Indian Mole-rat" (*Nesokia indica*, Blyth) cannot therefore be reckoned as identical with the field or garden-rat of Bengal which actually remained undescribed† until only last year; when Dr. J. Anderson, Superintendent of the Imperial Museum, Calcutta, gave a full description of it in Journal Asiatic Society of Bengal, Vol. XLVII, Pt. II, 1878, pp. 227-229. It belongs to the genus *Mus*, sub-genus *Nesokia* of Gray,‡ and Dr. Anderson has bestowed upon it the specific appellation of *blythianus* after the well-known Naturalist Edward Blyth,§ and it must now, therefore, be recognized as *Mus* (*Nesokia*) *blythianus*, Anderson. Nothing further need be said to elucidate its scientific nomenclature.

No minute description of this rat is here necessary, as it is more or less familiar to all gardeners in Bengal, who regard it with no kindly feelings; but it may be stated that the

* This purloining propensity was well-known to Elliot, who wrote of it as follows:—

"In its habits it is solitary, fierce, living secluded, in spacious burrows, in which it stores up large quantities of grain during the harvest *** The race of people known by the name of Wuddurs, or tank-diggers, capture this animal in great numbers as an article of food, and during the harvest they plunder their earths of the grain stored up for their winter consumption, which in favorable localities they find in such quantities as to subsist almost entirely upon it during that season of the year. A single barrow will sometimes yield as much as half a seer (1 lb) of grain, containing even whole ears of jowaree (*Holchus sorghum*.)"

† It is probably figured, however, by Gray and Hardw., Ill. Ind. Zool. Vol. I, 1832, Pl. XI, Mamm. and is there designated "The Indian Field-Mouse" (*Arvicola indica*, Gray.) It is there depicted as a brown rat with a short nude tail and large eyes, closely resembling the rat here noticed, but being wholly unaccompanied with any description of the animal, or even the locality whence it was obtained, the specific designation of *Indica* given to it cannot stand.

‡ Dr. Gray described it as a genus, and stated that "This genus is easily known from (*Mus*) by the large size of the cutting teeth and the comparative shortness of the tail; it appears to be intermediate to the Rats and "Rhizomys," i. e. Bamboo-rats. Dr. Anderson has proved, however, that its dentition is not so markedly different as to constitute it as a separate genus, and that it can only be regarded, at most, as a sub-genus.

§ Among his numerous articles on Indian Zoology is an elaborate paper entitled "Memoir on the Rats and Mice of India," Jour. As. Soc., B. Vol. XXXII, p. 327.

upper-surface is dark brown,—*providens* has a paler hue above, while the under-surface is not so intense and is tinged with grey. The tail, which is comparatively short, being from six to seven inches long, is usually less than the length of the body exclusive of the head. Its claws, though small and compressed, are strong. The length of the body, inclusive of the head, in the male varies from eight to nine inches,* and even more, while the female is a couple of inches or so smaller, and is further distinguished by the possession of sixteen mammæ placed from the pectoral down to the inguinal regions. It is rather prolific, and produces from eight to ten at a birth.

Its predatory habits are well-known, and it not only stores up grain in its burrows, but destroys a lot of plants in gardens, such as peas, etc., by biting their stems, which it also carries away into its holes. On this head Dr. Jerdon states:—

“This rat is occasionally destructive to tea trees, biting the roots just below the surface; more I believe, because they come in the way of their burrows than to feed on them. In the Government Tea gardens near Dehra many trees are destroyed by these rats, and the Superintendent is obliged to keep some men employed to dig them out whenever they betray their presence by the rat-hills of loose earth.”

I have frequently seen gardeners pouring water into the holes to drive the rats out, but with very little success, and this is not at all surprising considering that its habits are decidedly aquatic, as it dives freely. Regarding this trait of its character, Dr. Anderson says:—

“To test this aquatic power, I had two rats placed in a large wire bird-cage, and the cage partially submerged. If the rats, when in those circumstances, were much annoyed, they immediately dived to the bottom of the cage, where they could be observed running about under water.”

The burrows of this rat ramificate greatly, and it is therefore

* The Madras species *providens* does not attain this size; it is about two inches less in length.

a difficult task to find the main hole and dig it out, though this is, probably, the most effectual manner of getting rid of it.

They might also, I think, be destroyed by smoking them out of their holes, thus :—Apply burning grass to the mouth of one hole, while all the other apertures except one, from which smoke is observed to escape should be closed. This will either induce the rats to run out, when they can be easily killed, or they will be suffocated to death in their hole by the smoke.

Poison too might be advantageously used more freely than it now is : white arsenic, called *Shimul-khajár* in the bazar, might be mixed with grain and placed near the rats' holes.

It is generally active in its burrowing operations at night, but at times it works during the day, and when this is the case it can be easily shot with a fowling-piece loaded with small shot as it pops its head out of the hole.

The *bunnuah* coolies, or the *bágdi* class inhabiting the foot of the Rájmahál range of hills, do not hesitate to eat the field-rat, and it no doubt affords them excellent food, as it feeds on grain and vegetables. They also enjoy the flesh of the so-called flying-foxes or frugivorous bats (*Pteropodidæ*) which prejudice simply prevents us from including in our bill-of-fare, and relishing it, as it deserves to be. Col. Sykes states on this point that, he "can personally testify that their flesh is delicate and without disagreeable flavour."

The rat noticed by Blyth in his "Catalogue of Mammals and Birds of Burma," as *Nesokia indica*, Gray,* I am inclined to believe to be identical with this species; and if I am correct in my opinion, the range of its distribution must be extended to that province." It is there called by Blyth "the common Indian field-rat," and he states that Mr. W. Theobald found it in the Tounghoo district. My belief that this Burma rat is nought else than *blythianus*, is strengthened by a reference to Mr. W. Theobald's paper alluded to. *Vide* Proceedings

* Published as an extra number with Jour. As. Soc., B., Pt. II, Vol. XLIII 1875.

Asiatic Society of Bengal, 1866, p. 240. In it the dimensions of this rat taken in the flesh are given as follows :

MALE	.....	Body	.....	9·75	} =17·00
		Tail	.....	7·25	
FEMALE	.....	Body	.....	8·50	} =14·50
		Tail	.....	6·00	

This clearly establishes it to be of greater length than *providens*. Its colour too is described as "dark brown," which is the same hue as *blythianus* possesses, and it is stated to have sixteen mammæ and toes 4-5.

I am also inclined to think that the rat named by Dr. Mason in his work on Burma as "the white bellied rat" (? *M. robustulus* Blythe) is not the rat which commits such destruction in the rice-fields there, but *Mus (Nesokia) blythianus*, Anderson. Dr. Mason appears to have been misled by common native report, and writes thus on the subject :—

"In the province of Tounghoo they sometimes appear in immense numbers before harvest and devour the paddy like locusts. In both 1857 and 1858 the Karens on the mountains, west of the city, lost all their crops from this pest; and it is said that they are equally destructive occasionally in the eastern districts, but have not appeared for several years. *The natives say it is the same rat as the one that frequents houses.*" (The italics I am responsible for.)

The same author also quotes a letter from Mr. Cross, who wrote to him as follows :—

"The people in common with all who grow the hill paddy over an extent of country more than fifty miles square, are suffering a famine of rice. This is occasioned by swarms of rats, which devoured the paddy, or rather cut down the stalks, just as the ears begin to fill. The rats twice visited some parts of this territory during the season, so scarcely a stalk of rice escaped them. I met with two of these animals, swimming the Tenasserim, where it is more than

a quarter of a mile wide, and "succeeded in capturing one. This animal is about five inches from nose to end" (? base) "of the tail, of a slim and nimble appearance, the belly white, and the rest a mouse colour." (Might not this one have been a stray rat of another species than those which devoured the crops?) "During the rains when the river is much wider and more rapid, these rats crossed in columns, as the people say, so abundantly, that a boat in passing through caught bushels of them. They only make this appearance at long intervals like locusts of other places. It is said to be from twenty to thirty years since they visited the country before, to any great extent."

From the foregoing account it appears that the plague of rats, which is now acknowledged to be an evil of no small magnitude, takes place periodically, and it would therefore be well worth ascertaining the meteorological aspects and other conditions of the year in which they make their appearance in such numbers and destroy the crops, with the view of ascertaining the causes which produce the visitation, for it is hardly possible that it should occur fortuitously. With this suggestion I shall close my note.

KHULNÁ, (JESSORE,) }
2nd Dec., 1879. }

H. JAMES RAINEY.

P. S.—Regarding the occurrence of numerous similar species of mammals and birds in both the plans of Northern India and Burma, it may be stated that it indicates, to quote the words of Blyth, "the possibility of a closer connexion subsisting between the faunæ of the Upper Provinces of the two peninsulas than as yet we know of." I mention this with reference to *Mus (Nesokia) blythianus* being found in both places.

H. J. R.

Note on Sorghum saccharatum, as a new Food-grain for the Hill-people ; By CAPT. J. F. POISSON.

By this day's bangy post I have sent you twelve joints, taken from six well-grown Imphee (*Sorghum saccharatum*) plants, from which the crop of seed had been previously gathered. [The joints are unusually large.]

2. Mr. Duthie sent me a packet of the seed, (2 oz.) part of which was sown without any particular attention as to preparation of the ground, or its manuring. I expected a failure, and therefore only put down the seed to take its chance. They germinated freely, and grew rapidly and vigorously, and attained the height of from 6 to 9 feet, when they flowered and bore seed, which, having ripened, has been carefully collected and put by for next year's sowings. The seed crop has been abundant.

3. The unexpected success of this experiment is most important, for it gives the hill-people and all Tea Planters, from Almorah to Kangra, not only a new food-grain, but first class saccharine stalks, from which sugar of the best description may be manufactured.

4. Of the two ounces of seed I sent the greater part to Rev. Carleton at Arnee, and it grew there vigorously, the seed ears being very much larger than those gathered by me. The samples sent were full of immature seed. I do not know what use was made of the canes, then, or when the seed ripened.

The small quantity of seed left, was sown broadcast, on a plot of ground measuring 10 feet by 8 feet. The number of canes which sprung from one root, varies from a single $\frac{3}{4}$ inch in diameter cane to 5 canes, of various diameters, $\frac{3}{8}$ s. of an inch being the thinnest. The number of stools, (*i. e.*, rooted plants, from which canes single, double, and quintuple have sprung) counted is seventy-one, representing as many seed. The seed collected, cleaned and bottled, weighed 2 pounds 12 oz. Now as this was produced from a plot of land measuring 80 square feet, the yield per acre is 1496 pounds or 18 maunds,

Note on Sorghum saccharatum.

7 seers, $3\frac{1}{2}$ chittacks. The result therefore as a grain crop is considerable, and would no doubt have been much greater had the land been properly manured with bone-ash, and roasted limestone reduced to powder

I hope D. V. next spring to get a lot of this seed sown. The natives are willing to sow the Chinese sugar-cane, and as up to yesterday one month's severe frost had in no ways affected the growing plants, it may be called frost-proof. Of course snow would break the stems, and foreseeing a coming snow storm, all the canes were cut and distributed yesterday evening to the great delight of the recipients.

5. Thanks to the Russians, and the Affghans, the conquest of Affghanistan has been forced upon the British Government, and as we may, and must hold and govern the country till the heir to the throne is fit to rule, industries will have to be introduced which, when developed, will make Affghanistan prosperous and rich.

The Chinese sugar-cane, or Imphee, having proved a success at this altitude, it is reasonable for me to draw the conclusion that it will thrive and flourish in all parts of Affghanistan, where the grape-vine does the same. The finest and sweetest of grapes are produced on vines, growing on soils rich in lime, and in the West Indies the finest crops of sugar-cane are raised on soils remarkable for their richness in lime : hence, it follows, that the production of a rich sweet juice in the grape and sugar-cane, is due to the presence of lime in the soil. The sugar-cane of China, however, requires a cold climate, to produce a succulent stalk, and as in Affghanistan we have a suitable soil and climate, the production of all varieties of sugars, from the Chinese sugar-cane, may be safely predicted.

According to the English (London) newspapers, Affghanistan possesses a population of six millions, and as the *Kohat salt mines* have hitherto supplied these sixty lacs of human beings with culinary salt, at what may be called a nominal duty, the enrichment of the agricultural population by the

local production of sugar, will enable them to pay the full duty of Rs. 3 or Rs. 3½ per maund of salt, delivered at the mines.

The constant cry that Afghanistan will not pay for its keep, may now perhaps be abandoned, for a country which can produce sufficient sugar to supply the wants of Central Asia, need never complain of want of funds, and as the salt duties will certainly yield one million sterling per annum after all expenses are paid, the interest on loans, raised for the development of the resources of Afghanistan, may be easily met by the income derived from the excise on salt and sugar, the produce of the *Sorghum saccharatum*.

KOTEGURH, 18th December, 1879.

The Gardener's Note-book, No. 24. New mode of multiplying plants on the upside-down principle.* By T. M. FRANCIS, ESQ.

My upside-down cuttings have turned out splendidly. They were put down on the 26th ultimo, and I turned them out to-day. A very large number have formed a callus (some at both ends) and I have planted them out, having all the failures carefully collected. In due course I will send you a report, showing the number which were put down, and the results. I am sorry that you did not try the experiment this year, as it is now too late, at all events for Upper Bengal.

I have been counting the cuttings, and may as well make my report now. On the 26th November I put down 430 rose cuttings, burying them upside down in the manner which I have previously described. On the 25th December I turned the cuttings out of the wine chest in which they had been buried, and planted out those which had formed a callus,

* See No. 22 at page 54 of this volume.

Cultivation of Mulberry trees.

carefully putting aside all those which had failed to do so. Many of the cuttings had formed a callus at each end ; but I did not try the experiment of planting them upside-down, as I had barely room enough for the cuttings. Out of the 430 which I put down, 381 had formed a callus, and 49 had either withered or failed to form a callus. I will let you know hereafter how the cuttings get on. As they were put down much earlier than those which I tried last year, I trust that they will have become established on their own roots before the hot winds set in.

Mozufferpore, 26th December, 1879.

My upside-down rose cuttings are doing well. I find it answers better to water them by hand than to flood them from the well. Those which were treated in the former way were more advanced and look healthier than those which the *mali* flooded. I have already sent you a report of the percentage which formed a callus, and will let you know the ultimate result. There is one cutting which I am watching with considerable interest. It had formed a callus at each end, and the *mali* planted it upside-down. So far, it is doing well and sending out shoots ; in fact, it was only the position of the thorns which shewed me it was upside-down.

3th January, 1880.

*Correspondence regarding the cultivation of Mulberry trees, in connection with the extension of Silk industry. (Communicated by the DIRECTOR, DEPARTMENT OF AGRICULTURE, N.-W. P.),**

To

THE SUPERINTENDENT, BOTANICAL GARDEN,
Saharunpur.

SIR,

I HAVE the honor to request your assistance in obtaining information and in carrying out experiments as regards

* In a letter to the Secretary, Agri-Horticultural Society, in which he requests any further available information,

Cultivation of Mulberry trees.

the propagation of mulberry trees in localities likely to be useful in extending silk industry.

2. There are, I understand, three varieties of mulberries in the Dún—

(1), The common native mulberry, of which the leaves are not so useful for silkworms as of many other kinds;

(2), A large-leaved variety which is possibly the same as that introduced by Doctor Jameson as a Chinese tree to Saháranpur;

(3), *Morus alba*, species unknown.

3. (2) and (3) are both serviceable for silkworm breeding, but (2) is stated to be the most useful on account of the greater succulence and tenderness of the leaves. There is, however, an impression in the Dún that (2) is more difficult to rear than (3).

4. The system now followed in the Dún is to bring down silkworm eggs from the hills at the season when the mulberries first begin to sprout, so that feeding may be completed and cocoons spun before the extreme hot weather commences. But I have ascertained that at Madhopur in the Panjáb breeding is continued for several months in the year, and that five or six kinds of mulberries are employed, so that leaves are found for the worms at different seasons.

5. I suggest that the following steps should now be taken:—

(a). Enquiries should be made by you in the Dún, when you next have the opportunity of making them, as to the varieties of the mulberry now there, as to their suitability for silkworm feeding, and the way and season in which they can best be propagated.

(b). Enquiries should be made by letter from Mr. Watson, Manager of the Madhopur estate, as to the varieties of mulberry propagated there, and as to the character of

Cultivation of Mulberry trees.

each with reference to silkworm rearing. Specimens of leaves, &c., should be asked for botanical examination. If necessary I shall be glad to accompany you to Madhopur for personal investigation.

(c). Enquiries should be made from Italy and Kashmir as to the best kinds of mulberries used there in the silk industry, and specimens obtained for future propagation* at Shaharanpur. Any information as to the best methods of propagation by cuttings, grafts, or otherwise will be useful.

(d). The officer in charge of the Dún forest plantation should be asked if he is willing to establish an experimental mulberry plantation in which the various kinds may be planted—(1), with the object of scientific observations of the season and period of leaf production, and of the suitability of the Dún climate to each variety; (2), with the object of the future propagation of the best kinds for distribution in the Dún or elsewhere.

(e). A similar plantation or plantations should be made at Haldwani or other suitable places in the Sub-Himalayan districts to the east. I will make arrangements for these if you will inform me at what season it should be commenced. An early reply to this enquiry is requested.

(f). Large stocks of cuttings should be sent to the local authorities of the same tracts, at the proper season, of any kinds of mulberry (of which you can at once secure a supply from Saharanpur or the Dún), which are known to be superior to the ordinary mulberry trees of the country for the purposes of silkworm breeding. I will arrange for their reception and distribution if you will inform me—

(1) What quantity can be sent?

(2) At what season?

I shall be obliged if you will be good enough to draw up a note on the mulberry trees now in the North-Western Provinces for submission to the Government of India with Mr. silk report, which will probably be forwarded in the

course of two or three months. This might be accompanied by any extracts from Dr. Loudon's book of which it will be useful to have a reprint.

30th April, 1879.

No. 3041, dated Shaháranpur, the 18th August, 1879.

From—J. F. DUTHIE, Esq., Supdt., Govt., Botanical Gardens,
N.-W. Provinces,

To—The Director of Agriculture and Commerce, N.-W. P. and
Oudh.

SIR,—I have the honour to forward some information regarding mulberries and their cultivation in North-Western India, as requested in your letter No. $\frac{915A.}{No. 5-L}$ dated 30th April, 1879.

2. The facts which I have been able to ascertain, with respect to para. 5 of your letter above referred to, are as follows:—

A. *Mulberries in Dehra Dún*.—There are three or four varieties cultivated there for the supply of food for silkworms:—

1. The common, so-called, country variety or varieties (*Morus tatarica*, *indica*, and *parviflora*);

2. *M. chinensis*

3. *M. multicaulis* } Forms of *Morus alba* var. *latifolia*.

No. 1 is easily cultivated in this part of India, but the leaves are inferior to the other two for feeding silkworms.

No. 2 has larger and broader leaves; it affords excellent food for the silkworms, but requires greater care in cultivation. The original plants were introduced from China by Dr. Jameson, and there are still a few trees of this kind in his garden at Chandwalla.

No. 3 has still larger leaves, and they are equally good as those of the preceding for feeding purposes. It has the further advantage of being more easy to cultivate. There appears to be plenty of it in the Dún. Mr. Nelson, Manager of the Arcadia Tea Plantation, was kind enough to send me some specimens for identification.

B. *Mulberries at Madhopur*.—In reply to my letter to Mr. Watson, Manager of the Madhopur estate, requesting him to favour me with information regarding the various kinds of mulberry cultivated there, he was good enough to send me leaves of the following:—

1. *Morus chinensis*.

2. Country variety.

3. Philippine (= *M. multicaulis*, probably).

4. Shah (= *M. chinensis*, probably).

5. *M. alba* var.

Cultivation of Mulberry trees

Of these, Mr. Elliot (who procured the above specimens for Mr. Watson) remarks:—No. 1 is the earliest to break leaf by 2 to 3 weeks. Regarding No. 5, Mr. Watson says that there is only one tree of it in the station. The fruit is black and about $2\frac{1}{2}$ " to 3" long. The tree is growing in the forest bungalow compound, but was there some years before the ground became Government property, so that its origin is not known. The leaves sent are about 1 foot long and 6 inches broad. They most resemble those of No. 3, but more material is required for botanical identification.

C. *Enquiries from Italy*.—Application has been made for a supply of cuttings and grafts of good varieties from Italy, on receipt of which they will be retained at Shaháranpur for propagation and distribution.

D. The officer in charge of the Dún forest plantations has expressed his willingness to undertake the cultivation of various kinds of mulberry with a view to determine those which are most suitable for particular localities.

E. In reply to the latter portion of this section of your para. 5, I have already remarked in my No. 1848, dated 26th ultimo, that the mulberry being a deciduous leaved tree, its propagation by cuttings, &c., and the distribution of these, are best carried out during the cold season.

3. As desired in your para. 6, some further information regarding mulberry trees and their cultivation in the North-Western Provinces is herewith separately enclosed.

Mulberries and their cultivation in the North-Western Provinces, with special reference to their suitability for the rearing of silkworms.

The different kinds and varieties of mulberry belong to the genus *Morus* (Nat. Ord. *Moraceæ*), the botanical characters of which may be briefly stated as follows:—The flowers are "incomplete," i. e., they are deprived of one of the whorls of protective organs known as sepals and petals; they are also "monoecious," which means that the flowers are of two kinds, male and female, and that both kinds are found on the same tree. Occasionally, however, only one kind of flower, male or female, is found on one tree, constituting the condition known as "dioecious." The flowers are arranged in spikes or globular heads, of which the female ones remain on the tree to ripen. The sweet succulent part of the latter is composed of the single whorl of protective organs (perianth) which continue to enlarge until the fruit becomes ripe.

The mulberry genus (*Morus*) inhabits the tropical and temperate regions of Asia and America.

M. Bureau, in volume XVII. of De Candolle's *Prodromus*, recognises five species only, of which *M. alba* is made to include

Cultivation of Mulberry trees

a very large number of varieties, several of which have been described by other authors as so many species.

The specific name "alba" becomes inaccurate when used to include all the varieties described in the above work as the fruit of many are as often dark coloured as they are white.

As far as regards the sericulture of the North-Western Provinces, the following six kinds only need be mentioned here, viz. :—

- | | |
|---------------------------|----------------------|
| 1. <i>M. multicaulis.</i> | 4. <i>M. indica.</i> |
| 2. <i>chinensis.</i> | 5. <i>scrata.</i> |
| 3. <i>tatarica.</i> | 6. <i>lœvigata.</i> |

Of these, the three latter occur wild in various parts of North-Western India.

(1) *M. multicaulis* Loud^r ().—This is by far the most useful kind we have at present. It is easy to propagate, and the leaves are very suitable food for silkworms. It has been cultivated in this country for more than thirty years, and is now plentiful in Dehra Dûn and in various parts of the Panjâb.*

The following account of the plant is from Loudon's *Arboretum et Fruticetum Britannicum*, volume III., page 1348.

"This variety was introduced into France, in 1821, by M. Perrotet, 'Agricultural Botanist and Traveller, of the Marine and Colonies of France, from Manilla,' the capital of the Philippine Islands, into which country it had been brought as an ornamental tree, some years previously from China. It is considered, both in Italy and France, as by far the best variety for cultivation as food for the silkworm. It is a tree, or, rather, a gigantic shrub, as the name implies, of rapid growth, with vigorous shoots, and large pendulous leaves, which, even in poor dry soils, are six inches long and eight inches or nine inches broad; but which, in rich humid soils, are often one foot in breadth, and fifteen inches or sixteen inches in length. They are convex on the upper surface, of a beautiful glossy green, and of a succulent texture. The fruit of this variety was unknown in Europe till 1830. It is long, black, and of a flavour somewhat resembling that of the common black mulberry. This variety of mulberry differs from all the others in throwing up suckers freely from the roots. It also strikes more readily by cuttings, either of the young or old wood, than any other variety. It is extensively propagated in the French and Italian nurseries; and it has also become a favourite variety in North America."

2. *M. chinensis*.—This variety was introduced from China by my predecessor, Doctor Jameson, between thirty and forty years ago. The leaves are considered to be excellent food for silkworms; they are not so large as those of the preceding. It is a less hardy plant, however, and this circumstance does not favour its being cultivated in similar localities to the same extent.

* Some interesting information regarding this kind of mulberry will be found in vol. viii. *Transactions, Agricultural and Horticultural Society of India*. Ed.

Cultivation of Mulberry trees.

3. *M. tatarica* (Linn).—"Leaves cordate serrate rather obtuse, entire sometimes sinuate or even lobate, without pubescence. Fruit small ovate, oblong white, juicy but insipid, apparently dioecious."—*Rosburgh Flora Indica*, volume III., 598.

4. *M. indica* (Linn).—(*M. parviflora*, Royle) Vern. Tút (Panjáb), tútri (North-Western Provinces), Tút (Beng.), Tula (Sanskrit). Leaves small ovate cordate acuminate, sometimes lobed, fruit small ovoid or round black when ripe. This plant occurs wild on the lower parts of the Himalayas, extending from Kashmir to China and Japan. It is the kind which is used principally in Bengal, Burmah, and Southern India for feeding silkworms; and is the only one to which a Sanskrit name has been given.

5. *M. serrata*.—Roxb., (*M. pabularia*, Decaisne) Vern. Kimu (North-Western Provinces). Krún (Panjáb), a Himalayan tree, common at from 2,500 to 9,000 feet. It flowers from April to May; the leaves break in May. It has a long purplish fruit, which ripens from June to August. The leaves are coarse and can hardly be recommended for silkworm food. Its cultivation at a lower level might develop good qualities.

6. *M. lævigata*.—Wall (*M. glabrata*, Wall), Vern. Tút—a moderate size tree, leaves large smooth cordate acuminate, sometimes lobed, fruit long cylindrical, whitish or pale purple, sweet but insipid.

Wild and cultivated on the Himalayas from the Indus to Assam: also in Burma. It flowers from November to March, and the fruit ripens from March to May.

The above kinds of mulberry are those which occur either in a wild state, or are at the present time cultivated in Northern India.

There are many other cultivated varieties which it may be desirable to introduce, in order to test the suitability of each for different localities, both in regard to the time when the new leaves unfold, and the effects of soil and climate on the quality of the leaves as food.

There are different opinions as to the origin of *Morus alba* (in the restricted sense), but probability is strongly in favour of China as its native country.

Some useful information, regarding the white mulberry and its cultivation, may be found in Vol. iii. of Loudon's work abovementioned, from which the following extracts are here given (pp. 1850-7):—

"Description, &c.—The white mulberry is readily distinguished from the black—even in winter, by its more numerous, slender, upright growing, and white-barked shoots. It is a tree of much more rapid growth than *M. nigra*, and its leaves are not only less rough and more succulent, but they contain more of the glutinous milky substance resembling caoutchouc, which gives tenacity to the silk produced by the worms fed on them.

Cultivation of Mulberry trees.

"They are generally cordate and entire, but sometimes lobed, and always deeply serrated."

"*Geography.*—The white mulberry is only found truly wild in China, in the province of Seres, or Serica; it is, however, apparently naturalised in many parts of Asia Minor and Europe; and nearly all its varieties are of European origin. It does not embrace so extensive a range of country as *M. nigra*, being unable to resist either great cold or great heat."

"*Properties and Uses.*—The bark, and more especially the leaves, of the white mulberry abound in a milky juice, which is found to have more or less of the properties of caoutchouc, according to the climate in which the tree is grown. It is thought by many to be owing to this property in the leaves of the mulberry that the cocoons of the silkworm have so much more tenacity of fibre than those of any other insect that feeds on the leaves of trees. Hence, also, the silk, like the tobacco and the wine, of warm climates, and of poor dry soils, is always superior to that produced in colder climates, and from rich and moist soils. The fruit of some of the varieties, particularly of *M. a. multicaulis*, is used for making robs and syrups; and is said to be remarkably good to eat; for which reason this variety, in warm climates, might be introduced into orchards. The bark is also used, like that of the lime tree, for making bast for mats. The wood weighs only 44 lbs. per cubic foot, that of the branches is used for vine props, posts, and rails, and fire-wood; and that of the trunk for making wine casks, for which it is highly valued, as it is said to impart an agreeable violet-like flavour to white wines."

"*Mulberry Plantations.*—The leaves of the Mulberry should be gathered for feeding the silkworms when perfectly dry, after the dew has disappeared in the morning. The person employed to gather them strips them off upwards, and deposits them in a bag kept open with a hoop, and provided with a loop and strap to pass over his shoulder. When the leaves are gathered the trees must be stripped entirely of every leaf; as this is found not to injure the tree half so much as if only part of the leaves were taken off. In America, the operation of stripping off the leaves is often repeated a second time of the same year; but in France and Italy the tree is very rarely subjected to so severe a trial."

"*Soil, Situation, Propagation, and Culture.*—The white mulberry is more tender than *Morus nigra*, and requires more care in choosing a situation. Calcareous soil is said to produce the best silk; and humid situations, or where the roots of the tree can have access to water, the worst. A gravelly or sandy loam is very suitable; and trees grown on hilly surfaces, and poor soils, always produce superior silk to those grown in valleys, and in rich soils. The tree is propagated by seeds, cuttings, layers, and grafting. To obtain seeds, the berries

Cultivation of Mulberry trees.

must be collected from trees which have been known to produce male catkins the preceding spring. The berries are either gathered when quite ripe, and left to become dry before the seed is separated from them; or they are put into water as soon as gathered, and rubbed so as to separate the seeds, which are cleansed from the pulp in the water, and then rubbed dry on a linen cloth, and either sown immediately, or mixed with sand, and kept till wanted for use. In the south of France, the seeds are sown as soon as the fruit is gathered, and plants come up the same autumn. *M. a. multicaulis* is always propagated by layers or cuttings. Count Dandolo recommends grafting the species with the large leaved varieties, near the ground, the third spring; but most writers on the silkworm appear to prefer seedling plants, or plants raised from layers or cuttings to grafted ones. In pruning, cutting in, or heading down, the trees, the great object is to preserve the equilibrium of the heads, so that the sap may be equally distributed through the branches on every side. On this depends the production of a crop of leaves of equal quality on every part of the tree, which is alike important both for the first crop, which is given to the worms, and for the second crop, which is required for the nourishment of the tree."

Note by Mr. C. E. Blechynden.—In Bengal (to which alone my experience extends) *Morus Indica* is the species of mulberry most largely cultivated for feeding silkworms. *Morus multicaulis* may be here and there met with, but it is not the kind planted by Sericulturists. The plant thrives best in a soil that is not too humid and the roots strike deep: in hard soil, the roots are more on the surface. Where a new field is laid out the first crop of leaves are large, but from constant plucking of the bushes soon degenerate, and harden very quickly. If properly cultivated it is the best kind of mulberry to lay out for silkworm feeding, being readily propagated by cuttings, and is hardy, whilst the other varieties of *Morus* are apt to have their stems attacked by a worm, which causes many parts to become hollow. In growing mulberry of a species with large leaves there is economy, as one leaf of a large size will feed more worms than a small leaf; but my

experience does not point to the worm making more silk or greater tenacity. The welfare of a worm and its powers of production, as regards silk, is only attained when leaves suited to each stage of its growth are given; in the first stage there is no secretion of the growing substance from which it spins its cocoon; examination will show up to the third stage the ducts empty; it is only in the fourth partly, and in the fifth that the ducts are full at these stages; if the worms are fed on large young leaves the secretion of gum will be poor. I have found no difference in the tenacity of the thread produced by worms fed on other than *Morus Indica*, where the rule has been followed of giving leaves suited to the stage to which the worm has attained.

Supplementary Memorandum on the new system of Grafting Mangoes; BY J. PHILLIPS. •

WITH reference to Mr. Scott's note about difficulty of watering the young plants while being grafted, the following remarks are added:

2. Gooty pots are not required nor were they used; for I find that if the seedlings are lifted with a small ball of earth, they do not require watering after the first few days, unless there occurs a break in the rains, which if constant are sufficient.

3. Should they want watering the better way is to use a garden syringe. By this means one man is able to water 1,000 plants in two or three hours, and as the water can be squirted any reasonable height, the necessity for climbing the tree is avoided.

4. Of the first batch of plants grafted, six were cut on the 21st day. Four lived and two died. Examination showed that the two that died were not so carefully grafted as the others: twenty-one plants of the same batch were cut on the 30th day, three of which only have died. Subsequently,

New system of grafting Mangoes.

1,400 plants were put down, 650 of which were grafted from a single tree without harming it in the least, and it is now impossible to tell that any grafts had been taken from it. The remaining 750 were taken from several trees, in order to procure the different varieties. Subsequently, a few seeds were sown on the 15th of August, which were lifted and grafted on the 3rd of September. The wood selected was of the year's growth, but each plant grafted had two or three shoots each, instead of as at first only the single leading shoot. These were cut on the 14th October when they were thoroughly well united. They are now growing well, covered with foliage, and $1\frac{1}{2}$ feet high, with three strong shoots the length of each from the point of bifurcation being 11 inches. Plants of this size will be in good condition for planting into their permanent places next rains, when they will only be one year from the seed. I find that the later in the season they are put down, the longer they take to unite owing to the wood having become harder and the growth of the tree less.

5. With reference to Mr. Ridley's suggestions that grafts on young seedlings will give rise to luxuriance rather than fruitfulness, this result will only take place (if it takes place at all) in the earlier years of the life of the tree; it will not affect it at a mature age when it will be all the stronger. Mr. Ridley's objection that the graft will not continue unimpaired the true character of the parent tree, is not in my belief sound.

I shall be glad to send down in a week or two a few grafts to the Society and Botanical Gardens for trial.

ALLAHABAD, 31st January, 1880.

Notes on Kotegurh, and its agricultural products ;

BY CAPT. J. F. POGSON.

THE value of Kotegurh over Simla as a sanatorium is simply incalculable, and when it is borne in mind that the

water running from hundreds of springs is as pure as can be, whilst the air is absolutely untainted, cold and dry, conditions due to its perpetual descent from the snow clad Himalayas, the apparent neglect with which these priceless gifts of nature are treated by the public in general, and the sick in particular, is very remarkable.

Kotegurh Church has an elevation of 6,400 feet above the level of the sea, and the river Sutledge, visible from its door is 3,200 feet above that level, whilst Mount Huttoo, on one of whose stupenduous spurs Upper and Lower Kotegurh is built, has an elevation of 10,400 feet, and as all the North-Western spurs slope towards the Sutledge, the scientific and practical Horticulturist and Agriculturist has it in his power, by a judicious selection of sites and altitude, to grow all kinds of tropical fruits and crops on the banks of the Sutledge, and European fruits, flowers and vegetables at various altitudes; for every 530 feet of ascent gives a change of soil and climate, and accounts for rice, cotton, mangoes and plantains, growing at Kapoo, and superb English apples, and other European fruits at Burraree, (Upper Kotegurh,) whilst all kinds of American maize and pumpkins, choice English flowers and vegetables, as well as the *Jooar* of the plains, and the *Imphee* or sugar-cane of China, thrive in my newly made garden, a hundred feet or so below St. Mary's Church.

The pleasing task of improving the indigenous agriculture of the locality rendered it necessary that I should seek and secure the aid of the authorities, and through them of zemindars, whilst in the Rev. Mr. Rebsch, of the Kotegurh Mission, and Rev. Mr. Carleton of the American Mission at Arnee, I had most valuable supporters and fellow-labourers. I am greatly indebted to Baboo Goodroo Mull, who, in addition to being a zemindar, in possession of large ancestral holdings, is the Tehseeldar of the important Iron-producing district of Kot Khai, as well as of Kotegurh.

The *New Orleans*, and *Sea Island* Cotton seed obtained by me from the Agri-Horticultural Society, were made over to Baboo Goodroo Mull, who caused them to be sown on land owned by him at Kapoo on the right, or Kotegurh bank of the Sutledge.

[Mr. W. H. Cogswell, a member of the Cotton Committee, has kindly favored the Society with the following report on the samples sent by Capt. Pogson:—

Sea Island unginned, good color, but a little stained, good and regular in length, silky but of weak and brittle staple, probably occasioned by being grown at such a high elevation.

New Orleans unginned, excellent color, staple fair and of good length but wanting in strength. The same remarks apply to this as regards elevation in the cultivation.]

In the samples submitted herewith, we have part of the first crop of these cottons ever grown within the Himalayas. The Paharees are greatly pleased with both kinds of cotton, and now I shall have no trouble in getting them to grow these, in place of the indigenous kind, therefore in due course may send me all the cotton seed you can spare for distribution to applicants. I may mention that weavers of cotton and wool are by no means scarce in these hills, hence the production of superior cotton wool will have a most beneficial result.

The varieties of Maize alluded to were—1st, "General Grant's Corn;" 2nd, "Golden sweet Corn;" 3rd, "Stowell's Evergreen Corn;" 4th, "Moore's Concord Sweet Corn;" 5th, "Mexican Sweet Corn," and 6th, "Early Canada Field Corn." These seeds were given me by the Rev. Mr. Carleton.

Mr. Duthie, Superintendent Government Botanical Gardens, Shaharunpore, in answer to my application, sent me as follows:—1st, "Yellow Canada Corn;" 2nd, "Red Cuzco Maize;" 3rd, "Striped Cuzco Maize;" 4th, "Yellow Cuzco Maize;" 5th, "White Cuzco Maize;" 6th, "Mammoth Sugar Corn;" 7th, "Gourd Seed Corn;" and 8th, "Red Indian

Corn," and as all the above came to maturity, whilst the seeds were largely preserved for this year's sowings, I have every reason to hope that from Kotegurh as a centre, these superior kinds of maize will gradually find their way into the hands of zemindars, and be cultivated far and wide in place of the very inferior indigenous maize of these hills.

In making my division of these seeds, I gave Rev. Mr. Rebsch a supply and kept a portion for myself, and our joint crops have been most successful, the smallest number of cobs on my plants (manured with bone-ash, and limestone in powder) being three, and the largest six, and in many cases so heavy were the cobs, that the growing plants broke down under their weight. As I was much pressed for room, several kinds of maize had to be sown in one plot of land, and the result has been most curious, for the "Red Indian Corn," and the "Red Cuzco Maize," have in numerous instances hybridized the other kinds: thus I have cobs of yellow Cuzco Maize, with numerous single seeds, and groups of seeds of a deep dull purple colour: White Maize with pale pink and striped seed, the stripes in some cases being pink, in others red or reddish. I have some cobs in which there are white and yellow grains, more or less striped red, and a few seeds of deep purple amongst them: thus showing treble impregnation, and indicating a possible means of improving the ordinary maize of the plains by crossing it with the red and striped Cuzco Maize, both kinds ripening seed early, and bearing large cobs, thickly, and perfectly supplied with fully developed seed. I find I have forgotten to mention the "Goldendust Corn," which you sent me with three other kinds, the former bore abundantly and a good supply of seed has been preserved, and the latter were sent to Komharsun, to the Rana's mallee, whose report has not yet been received. The *Jowar* (*Sorghum vulgare*) of the plains, it was stated, would not grow up here, and being of a contrary opinion, I obtained some seeds which

Kotegurh, and its agricultural products.

were sown, the plants grew well, and the crop of ripe seed harvested has dispelled the popular fallacy connected with the subject. In like manner, it was affirmed that gram (*Cicer arietinum*) would not grow here, and this fiction was similarly disposed of. The price of gram is never less than two annas a seer, and six seers of it per rupee is the price during the season when travellers have been fleeced by the bunneeahs, who being directly interested in the matter, do not at all approve of my small gram field, or that of the zemindar who is growing it at my suggestion, with seed supplied by me, the price demanded being beyond his means.

I now come to my Pumpkins, of which I have three superior kinds, the flesh of all being of a deep golden color, crisp and firm, the smell and taste exactly resembling that of a good cucumber, and as all have been so eaten, uncooked, the value of the fruit is apparent. All are very good to eat cooked in various ways, and all make very nice preserve. No. 1 produces round fruit, the skin being milk white. No. 2 is called the *Turban Squash*, and has kept perfectly since last October, and No. 3 is the Giant Pumpkin of Chili.

Rev. Mr. Carleton sent me four seeds of it, all of which germinated and flowered profusely; the constant rain interfered considerably with the impregnation of the fruit flowers, and a good deal of perfectly formed fruit was in October destroyed by frost, and during the rains by some insect. Five pumpkins of various weights, ranging from five to thirty pounds were cut and eaten, one large pumpkin of over forty pounds was stolen by a Paharree, and I had five matured pumpkins when the frost set in. These were cut and weighed as follows:—No. One, 131lbs., 10½oz; No. Two, 120lbs., 5oz.; No. Three, 95lbs., 4oz.; No. Four, 75lbs., 3oz.; No. Five, 52lbs., 7oz. Total weight 474lbs., 13½oz.

I have the pleasure to present the Society with three hundred seeds of this monster pumpkin known at Kotegurh as the *Mata Kuddoo*, and I also present seeds of the two

other kinds, and in addition, a packet of *Ohiretta* seed for experimental culture in England, where it should answer.

I have forwarded in the parcel two cobs of Maize, the dark red striped cob shows how well this variety grows up here, and the yellow as a good specimen of crossing.

I trust some Members of the Society will try the experiment of improving the common maize of the country by hybridizing with the red striped kind and report the result, and I will do the same; and if by our joint exertions, the numbers of cobs per plant as well as the gram is increased, a positive boon will have been conferred on the people.

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OF
INDIA.

*Remarks on a Cattle disease in the district of Kangra, its
treatment and remedy. Communicated by P. DE LAVAL
LENNOX, Esq.*

As the following may be beneficial to cattle owners in the various countries with whose Agri-Horticultural Societies your Society corresponds, as well in India, I have much pleasure in making known to you the form of cattle disease at present occurring in this district of Kangra, its remedy, and treatment, for communication to all whom it may benefit.

Symptoms, in the order they usually occur. Listlessness refusal of food, flabbiness of ears, flowing of mucous saliva loosening of teeth, aguish shiverings, excessive relaxation of the bowels, increasing till accompanied with blood, and previous to the knowledge and use of my remedy, usually resulting in death.

Remedy.—The leaves of the wild strawberry, (the cinquefoil variety seems to be the most effectual. There are at least two varieties of trefoil also indigenous and plentiful up here) pounded to a pulp and made into boluses, the size of a hen's egg. I am of opinion that the garden varieties would prove equally, if not *more* beneficial.

Treatment.—Permit the disease to run its course until four or five evacuations have occurred so that the bowels may be cleared of any noxious substances and relieved of their heat.

~~Notes on a Cattle disease in the district~~

~~Notes on a Cattle disease in the district~~ of the strawberry leaves and repeat the ~~same~~ every third hour till the purging has been overcome, and ~~continue~~ the boluses as soon as this result has been satisfactorily ascertained, otherwise excessive costiveness will result and recovery be delayed. This is really the whole treatment as far as physic is concerned.

Memoranda.—In the case of my own cow, I observed the following results:—

During the first bolus interval the aguish symptoms speedily disappeared, and the salivation was much reduced.

Second bolus interval, salivation entirely ceased, and purgings less frequent.

Third bolus interval, evacuations still less frequent, and the animal began to sniff at its fodder. On noticing this my cowherd gathered some leaves of the Karáli (Pahari) Kachnár, (Hind.) *Bauhinia variegata*, and mixed them with hay to coax an appetite as there was little other green food obtainable in January.

During the fourth bolus interval the cow eat a little of the fodder from which I inferred that the teeth were again firm in their sockets or at any rate getting so. The evacuations had ceased but as they might possibly re-occur during the night a fifth bolus was given at about 9 p. m.

At 8 a. m. next day a small feed of about a seer of Kanaká Dallá (wheat meal, very coarse) boiled and allowed to cool "milk warm" was given and evidently appreciated. The same for three other feeds, evenings and mornings, with "chill off" water to drink when thirsty.

I have experimented with this treatment and remedy on 33 head of cattle, and recovery has been the result in each case. I have some ten cases under treatment now, and the owners report rapid and steady improvement.

I communicated this remedy to the Deputy Commissioner, Kangra District, who has been testing it in each Tahsil, and is now sending a report on it to the Punjab Government, in

of Kangra, its treatment and remedy.

which it is affirmed to be successful in almost every instance, (I think I might write in every instance, but the copy of the report has not yet reached me, and it is best to be on the safe side when making a statement) where it has been used as directed in "The Valley."

The reports from Kúlú, where the disease was most virulent are unsatisfactory up to the present, but the reason of this I opine to be that the dried specimen plant sent to them has not been recognised, and that the name of the plant Lál Akhá in Dharmasala, Palampur, may not be that by which it is known in Kúlú.

The people of Mandi and Sukeit territories seem to be so non-plussed by the dried specimens and written instructions as to be unable to reply to repeated "reminders."

A special messenger well acquainted with the remedy and its use is being got ready to take a circuit through all three places, and as this is being done by the district authorities who have applied to me for a native who has greatly aided me in spreading the knowledge of this blessing to the villages surrounding my tea plantations, they, the district authorities, evidently have some faith in the strawberry leaf remedy.

The absolute absence of all expense of the remedy in this valley is a great thing, and I suppose it could be used from one end of the Himalayas to the other "without money and without price" the same as up here.

I have suggested to the Deputy Commissioner of this district that it might be advisable to grow the Strawberry plant in quantity in each jail garden in the plains where the plant *will* grow, for distribution either of leaf or plants to such as need them, if the domestic varieties are found to act the same as the wild varieties have in our experiments.

I lay no claim to being the first to discover medicinal virtue in the leaves of the strawberry, for some 20 years ago I read of it being a cure for diarrhoea and dysentery in the human subject and have often used it myself, but having

Remarks on a Cattle disease in the district

found it so successful in my experiments with it for the cattle disease above mentioned, I am anxious that it should be made known wherever it may do good, and save to cultivators, whether poor or rich, the means of tilling their lands.

Should this interest you and be considered as valuable information, I will, if you wish it, send you a copy of the Deputy Commissioner's report in substantiation of what I have written, so that you may have proof, to lay before enquirers, my sole object being the greatest good to the greatest number.

I do not know the address of Captain F. Pogson, "Corresponding Member of the Agri-Horticultural Society of India," or would make this remedy known to him in his Himalayan home.

Hoping you will pardon my taking up your time with this subject which possibly may not be a part of your "Agricultural" work, and believing that your Society has, as its object the welfare of the Agriculturist as well as of the crops he grows.

BHAWARNA, }
17th April, 1880. }

Letter to the Assistant Commissioner, Kangra District.

Your letter of 9th and here is a hastily written report about the strawberry remedy for cattle disease, pardon verbosity and voluminousness as I have not time to think telegraphically.

On the 13th January, 1880, I was informed that cattle disease had shewn itself in the village of Bári, within a mile of my Balh Tilloo Tea Garden, on the district bridle road to Bhawarna. This of course set me thinking on the subject, and wondering what I should do if it appeared among my cattle.

A fact of which I was aware for many years came to remembrance, viz. that the young leaves of the garden strawberry were a certain and pleasant cure for diarrhoea and dysen-

tery in the human subject, and the idea was given to me that it might also be beneficial to cattle, suffering from what I suppose to be a dysentery peculiar to them, and as all my garden strawberry plants had died out, I could only suggest to those, I wished to make a trial of strawberry leaves, to use the wild varieties.

It was also given to me to think, that as "nature" always exerts itself and heals wounds, though sometimes exerting itself too much, that the later stages of this illness might be only the efforts of nature to rid itself of that which is noxious, having been excessive and brought on such aggravated symptoms as would occur if drastics were given to a greater extent than necessary for expelling the noxious contents of the bowels, or relieving any feverishness of the system.

The occurrence of the ague (shiverings) led me to infer that as in the human subject fever generally follows ague, so the later stages of the disease were the result of fever, and that the strawberry leaves would prove cooling to the system as well as astringent to the bowels.

On the 14th idem, when passing the houses of Bhikam Kotwal, and Gunga Ram Sunyasi I asked them to try the wild strawberry leaves, but from ignorance of the power of the medicine, I, fearing lest I might produce harm by prescribing too large doses, told them to give a good double handful of the leaves *au naturel*, morning and evening, for a couple of days and to use no other medicines, in order that I might be certain of ascertaining its effect; for many natives had told me "no remedy is known, some animals get well *without* any treatment, most die even under our treatment, but it is all *kismet* and 'PARALABT, whether they die or recover.'"

On the next day, (15th January,) I met Choonoo, a neighbour of Indur Katoch whose cattle were ill and some of which, as well as some of those of the other two men had died, and through him conveyed instructions to Indur.

Remarks on a Cattle disease in the district

These all used the new remedy and I was glad to learn daily that, but one death had occurred since using it, but that the other cattle were recovering rapidly, those treated shewing a disposition to return to their food after about 48 hours of the treatment. The one death happened to a buffalo belonging to Gungaram who, when the remedy had stopped the purging at the instance of an officious friend tried the juice of a seer of garlicks as a draught, purgings recommenced almost immediately, and the animal died within 10 hours.

On the 16th January a case occurred amongst my own cattle, the first symptoms having been noted about 9 A. M., but through fear of the bad name attaching to the disease, which is considered infectious, this was kept secret even from me, lest my plantation hands should desert *en masse* to avoid conveying it to their homes, for it is also believed that this ailment can be conveyed by the effluvium absorbed into the clothing of any person passing near an infected place.

The case was made known to me after a whole night of purging about 8 A. M., on the 17th, when strawberry leaves were procured and between 9 A. M., and 9 P. M., of this date five boluses of pounded leaves were administered by my servant in his eagerness to effect a speedy cure. About 4 P. M. I saw the cow nibbling at her grass amongst which the leaves of the Karali or Kuchnar (*Bauhinia variegata*) had been mixed; these I was told were to induce a greater appetite by their greenness and were also a "cooling food." The cow seemed pleased with and selected them from among the hay. Thus I learned that larger or at any rate oftener repeated boluses at short intervals were more beneficial than my previous treatment. On the 18th and 19th hay with karali leaves and wheat groats boiled and allowed to cool, about half a seer morning and evening as a nutritive easily digested and cooling diet were given.

I should mention that the use of the remedy was abandoned at 9 P. M. of 17th, as it had effected its purpose and had

even slightly over restricted the bowels, which, however, regained their normal condition by the evening of 18th. This case is fully authenticated having been treated under my personal observation.

The cattle belonging to the three natives above mentioned having by the 18th or 19th, nearly all recovered, I made it my business to communicate daily to all I met (cattle owners) the virtues of the strawberry leaf and its efficacy. In this, I have been greatly aided by the Bhawarna Bazaar Chowkidar Dass, whom I would bring to the favorable notice of the district authorities, he is temporarily serving in the Police here and being an "outsider" the duty of conveying letters devolves on him. During his itinerations he makes it an object to convey the news of the remedy to any one who has diseased cattle, and through him, sundry cattle in Alimpur, Tahsil Sujanpur have been cured, and to him is due the recovery of the cattle belonging to Devi Singh, of Poonur, entered in the statement annexed.

The symptoms as described by the natives and those noticed in my own cow agree and are as follows: Listlessness, flabbiness of the ears, refusal of food, flowing of mucous saliva, loosening of the teeth, aguish shiverings, excessive relaxation of the bowels, ending up with a dysentery continually increasing till death ensues, in most instances.

The mode of treatment I have now adopted, and which from all accounts is most effectual, is to permit the disease to run its course until four or five evacuations have taken place, and then to administer at intervals of three to four hours a bolus of pounded strawberry leaves, the size of a country hen's egg, until the purging has ceased. Hay and karali leaves are placed before the animal when signs of returning appetite appears, and a few feeds, $\frac{1}{2}$ a seer each of wheat groats (Kanak ka Dullia) as before noted, with tepid water as a drink for assuaging thirst. With the first one or two boluses the first symptoms including the ague disappear or nearly

so, and after that the purgings cease and the animal shews signs of returning appetite.

My cow, with the exception of having lost flesh, appeared to be as well as ever on the third day of the strawberry leaf treatment. The natives tell me that cattle thus treated by them recover in about five days. I have been told by many natives that, if an animal recovers from an attack of the disease, it never occurs to it again similarly, as in the cases of small-pox, measles, &c. in human beings; they also say, as regards the strawberry leaf, that by its checking the disease before it reaches its most virulent stage, it seems to prevent its spread even amongst cattle picketed in the same yard;—but of this I cannot write as a certainty.

I was glad to learn from your letter under reply that Mr. MacBean considers the remedy to have been effectual in the case of his cattle, and that the eight cases “recovered” in Hamirpur Tashil may be considered as well authenticated. I hope that the Dehra Tashil five cases may prove the same, and good accounts soon be received from Kúlú, Mundi, and other infected places.

I would suggest that if this remedy is thoroughly proved to be effectual, that the domestic strawberry should be grown in every jail garden in India, where this form of disease has occurred or may be feared, with a view to the distribution of plants to cattle owners, and leaves obtainable immediately the disease shews itself.

A late Pioneer noted that “Cattle disease has appeared in the Agra district.” Is this identical with our Cattle disease?

P. DE LAVAL LENNOX.

10th April, 1880.

P. S.—Naib Tehsildar Bhawani Das arrived yesterday, Dass Chokidar reported the disease in Gurh Jamula Tika Kalā, cattle owners Dedu and Sadama Brahmans, Bhikam Kotwal sent to see personally to administering of the remedy. To-day Naib Tehsildar went to Daini to see to some Cattle disease cases there. The Naib Tehsildar is taking great inter-

Statement regarding Cattle disease and its remedy in the vicinity of Bhawanra.

Name of Cattle owner.	No. of Cattle before disease appeared.	No. of Cattle that died before remedy was known.	No. of Cattle which died after using the straw-berry leaf remedy.	No. of Cattle reported as cured by the remedy.	No. of Cattle which escaped infection.	No. of Cattle which recovered previous to knowledge of the remedy.
Bhikam "Kotwal" Tika Bári, Mouzah Daroh ...	16	8	Nil.	8	Nil.	Nil.
Junga Ram "Súnyáí," Mouzah Bughwara ...	13	9	1*	3	Nil.	Nil.
Jandur "Katach" Tika Bári, Mouzah Daroh ...	14	9	Nil.	5	Nil.	Nil.
Mr. P. Lennor, Tika Balh Tilloo of Daroh ..	21	Nil.	Nil.	1	20	Nil.
Devi Singh "Sibáya," Mouzah Poonur ...	30	10	Nil.	16	4*	Nil.
.	94	36	1	33	24	Nil.

* This is the case in which a partial cure was effected when garlic juice was administered which brought on renewed purging during the night and the buffalo died by the morning.

BHAWANRA, 10th April, 1880.

P. DE LAVAL LENNOR.

Remarks on a Cattle disease in the district

I have not as yet obtained the Deputy Commissioner's report on the Potentilla Tormentilla or Ammon as a remedy for the cattle disease "enteric fever" prevalent here, but send you a copy of one made by Mr. Tucker, Assistant Commissioner to him. Mr. Tucker has had the working of the remedy, so the Deputy Commissioner's report, it is to be inferred, would contain about the same.

I have to thank you much for having furnished me with Captain Pogson's address.

P. DE LAVAL LENNOX.

BHAWARNA, 28th April, 1880.

*From F. TUCKER, Esq., Assistant Commissioner, Kangra, to
COL. C. V. JENKINS, Deputy Commissioner, Kangra.*

I HAVE the honor to forward herewith a very interesting report from Mr. Lennox, of Bhawarna, regarding the strawberry leaf remedy for the cattle disease now so prevalent in this district.

The enquiries which I have made under your instructions have fully borne out the figures as noted by Mr. Lennox.

2. You will observe that in Mr. Lennox's tabular statement out of 34 cattle suffering from the disease and treated with this specific only *one* died. The remainder all recovered within a period of four or five days.

3. From the subsidiary statement which I have myself annexed, and which includes the cases mentioned by Mr. Lennox, it will be seen, that out of 52 diseased cattle so treated, only one is reported to have died. Some other deaths occurred, I believe, on Mr. MacBean's plantation, but these are ascribed by him to maltreatment in administering the bolus either before or after the animal had purged (*sic in orig* : the meaning is before purging had set in or after it had been stopped.)

of Kangra, its treatment and remedy.

4 From Dehra, Hamirpur, and Palampur most satisfactory reports have been received, and this I ascribe to the fact that Mr. Lennox and myself have in these places personally and carefully explained the nature of the treatment. At the time that I started for Nadown last month I found that no effort whatever had been made in either Dehra or Hamirpur to make use of the remedy. After at once despatching a messenger for a supply of specimen plants, I was glad to hear that five diseased cattle treated in the Dehra Tahsil had recovered, and similarly eight in Hamirpur Tahsil. No animals that were put under this treatment died.

5. From Kúlú I have just received a very unfavorable report, it is said that the remedy is useless. This I believe to be due either to the instructions not having been understood thoroughly, or else to a foregone conclusion on the part of the Tahsil Officials.

I beg to suggest that Chowkidar Das, of Bhawarna, who has obtained considerable experience in the use of the remedy should at once be sent to Kúlú, and specially entrusted with the duty of making the remedy known, and seeing that it is properly applied. If this is done and he finds the Kúlú cattle so peculiarly constituted or obstinately determined to die, that the remedy will not affect them, then it will follow that the remedy is not so infallible as at present it appears to be.

But in a matter of such urgency and importance, I think some special steps are necessary, as at present the Tahsil Officials have shewn, to say the least of it, a dilatory spirit, and it cannot be expected that they will take the same interest in such a matter as the cattle owners themselves.

6. The evidence before me now is of such a nature as cannot but carry conviction. The cases which have been treated under Mr. Lennox's own directions are thoroughly authenticated, and his statements are entirely borne out by a neighbouring planter, Mr. MacBean, of Dhorni, who tells me that he lost a number of cattle before he heard of the remedy.

He informs me that he has since administered it with the most remarkable success to his own and other cattle.

7. I have sent specimen plants to Kúlú and every other Tahsil. I also sent a Múrásila with a number of specimens to the Rájá of Mandi, having been informed that the disease was very rife in his State, but have received no reply, nor do any steps appear to have been there taken to make use of the remedy.

It appears there are at least two varieties of the strawberry plant besides the domesticated kind, one appears to be confined to the higher ranges, and has a small white flower and a leaf of three divisions similar to the garden strawberry except in size. The other has not such a creeping character, a small yellow flower like the common ranunculus, from which, however, it is quite distinct and five fold division of leaf. [memo. the above was written before Mr. Tucker had fully examined them. White flowered strawberry does not grow near Bhawarna, but there are no distinct varieties of yellow flowered, *fruit bearing*, strawberry with trefoils and the cinquefoil which has a very small five petalled flower and fruit the size of No. 3 shot, which appear to "come to nothing," and which Mr. Tucker now calls *Potentilla Ammon* or *Tormentilla*.] This latter grows in lower places and is abundant on banks of the numerous "Kúls" (irrigation channels) in this valley. It is this species that has been used at Bhawarna (8,000 feet) and in Dehra and Hamirpur (about 2,000 feet) Tahsils. Probably the most effective kind would be the garden strawberry which Mr. Lennox says in his report is very beneficial in the human subject for diarrhoea.

The small white variety (4,000 to 6,000 feet) has not as yet been put to the test.

With reference to paras. 15 to 16 of Mr. Lennox's report, I would suggest that enquiries should be made regarding the locality of this disease. The symptoms are described by Mr. Lennox and need not here be repeated. The cattle owners

of Kangra, its treatment and remedy.

have informed me that it has all the virulence of ~~cholera~~, and that not only do cattle attacked seldom recover, but it spreads with fearful rapidity. Inquiry might also be made here and elsewhere regarding the origin of this disease. I am informed that it has always existed in this district, and there is some reason to believe that it usually extends along the most largely used trade routes.

(Sd.) F. TUCKER,

Assistant Commissioner.

Since the above was written, Mr. Tucker has sent the special to Kúlú (26th April,) and I on same date sent one to Mundi Raja from whom the Sukeyt Raja (in whose State a great Cattle Fair is yearly held, and from whence the Kangra Valley chiefly obtains bullocks for farm purposes) had been asking what is this "Ishtawurbhurri dawai."

Subsidiary Statement regarding Cattle treated with strawberry leaf remedy.

Village and Tahsil	No before disease appeared.	Died before the remedy known.	Died after using remedy	No reported cured by remedy	Escaped infection	Recovered before the remedy was known	REMARKS.
Bhawarna, Palampur, by Mr Lennox	94	36	1	33	24	0	Some of Mr MacBeans' cattle died owing (as he himself informed me) to maltreatment, & as to the leaves being administered when purging had either not commenced or ceased.
Dhorai, Palampur, Mr Mac-Bean	0	0	0	3	0	0	
Bajampur, Hamirpur, Chowkidar Das	0	0	0	2	0	0	
Musa Hamirpúr, Putwari and Tehaildar	0	0	0	8	0	0	
Garli, Dehra by Kotwal not authenticated (as yet by Tehail)	0	0	0	5	0	0	

KANGRA DISTRICT, 15th April, 1880.

(Sd) F TUCKER,

Assistant Commissioner.

"Foot and Mouth" disease.

A few remarks relative to the "Foot and Mouth" Disease.

Communicated by MR. W. STIRLING.

Prior to 1862, I have no knowledge, but during the spring of that year I noticed a few cases among the cattle in the vicinity of Bijdore, in the Rohilkund; my attention, however, was not particularly attracted to it, until 1863, when residing in the Déhra Doon, where chiefly among the village herds it was prevalent. From whence it was introduced or how caused I cannot with any certainty say. The tradition of the natives there, being generally, that it was introduced by the "Brinzaras" who then visited the Doon with large herds of cattle, both for sale and for transporting lime, &c. to the plains: this appears feasible as their cattle are often diseased and, wandering about as they do, would be a ready means of conveying infection from one district to another. I have myself frequently noticed numbers of diseased animals with them. Others again tell you that it is caused by the cattle greedily devouring the young grass that springs up directly after the periodical firing of the pasture grounds, and which generally occurs in February and March; this idea is, I fancy, vague and without any reliable data, other than that the plague generally becomes prevalent about that time and it does not apply to other parts of India where the same disease often rages.

From 1863, I noticed the plague as being almost yearly on the increase, and more noticeable among village cattle these are as a rule neglected and ill-fed during the winter. I think it was between 1803-5, that it attracted some attention in Central India and Bengal, but am not aware of any definite steps being taken against it, and have no particular knowledge of any thing concerning its prevalence in those provinces except from the local newspapers which merely reported cattle plague; "Foot and Mouth" disease, as committing ravages.

However, in 1868-69 and 70, the disease was so bad in the Dehra Doon, Meerut, and Rohilkund districts, that it became a rather serious subject, many ryots losing nearly all their stock. I then brought to the notice of the Superintendent of the Dehra Doon and Commissioner of Meerut, my method of treating the disease and which I had found invariably successful if the instructions were carefully carried out, of not only being curative but preventive, and isolating the disease to a few animals, instead of having the whole herd infected. Whether these gentlemen ever gave the remedy a trial, I know not; but during the three years in question I had a large herd of cattle under my care, and although there were numerous (and many very bad) cases in each year I only remember losing in 1868, one head (a stray Bringara bull) that was infected when it came into the herd and was the cause of the other cattle becoming diseased. In 1869 and 70, only five were lost through this disease although in the adjacent villages numbers were dying daily.

In 1874, the plague raged in Assam and Cachar, in the latter district so badly, as to seriously affect agricultural operations. I then placed my method of treatment at the disposal of the public, through the Chief Commissioner of Assam and the Deputy Commissioner of Cachar, how far any attempt was made in Assam (beyond publishing the recipe in the *Assam Gazette* for several weeks) to make use of it I do not know; but in Cachar, the treatment recommended was immediately adopted, and I had the pleasure of hearing from the Deputy Commissioner, that it was eminently successful. The disease now appears to be very prevalent in Bengal, more particularly towards and in the Darjeeling Terai and as it is most virulently infectious, no time should be lost in endeavouring to isolate and stamp it out. The remedy (a radical one truly) that has been adopted to prevent the spread of infection by immediately killing any infected beast is as ruinous as the disease and quite

unnecessary, as by the adoption of the treatment I have recommended, both the cure of infected animals and the further spread of the disease is reduced to a certainty.

One great cause of the spread of various forms of cattle plague is owing to the culpable indifference of native drovers, who wandering about from district to district with diseased animals in their herds carry the infection over a large area. I happened to be at Dhubri, in the early part of this year, and noticed large numbers of cattle being ferried across the Burrumpootra, for sale in Assam and in every herd there were many beasts affected both with "Foot and Mouth" disease and a very virulent dysentery (this the natives call cattle cholera) it is very infectious and as some of these cattle must have been taken up as far as the Luckimpore district, the late ravages among cattle in the vicinity of Dibrughur, can be accounted for. The disease was generally dysentery of very virulent type, and in addition there were many cases of "Foot and Mouth" disease.

As prevention is better than cure a little supervision exercised over the "Brinzara" carriers of the Upper Provinces, and the drovers and salesmen of Bengal would prevent much loss; as for instance as regards cattle imported into Assam from Bengal, they would all cross at Dhubri, and if the herds were inspected there and infected or suspected beasts placed in quarantine, the possibility of introducing disease into the valley would be reduced to a minimum, the same rule and supervision would answer for other provinces as some point could always be found at which cattle could be inspected, travelling as they always do by main or well known routes. The expenses of a staff for this purpose would be but trifling and could be met by a small fee levied upon all cattle moving from place to place either for sale or with "Brinzara" carriers. The benefit derived from the adoption of some system of supervision that would not be too obstructive to the free passage of sale cattle or in any way interfering with the business of those

engaged in the transport of goods, &c., while at the same time efficient, would be to the general public immense and could be most easily arranged.

Foot and mouth disease, Horned Cattle.

For the Mouth.

Honey	...	...	1 lb
Muriatic Acid	...	...	1 1/4 "

Mix well in an earthenware or glass vessel, with a wooden or glass rod.

Apply with a wooden spatula about a desert spoonful to the tongue leaving the animal to distribute it over the inside of the mouth by the champing motion that is sure to follow its application.

In ordinary cases this should be administered twice a day, but in very severe cases, or should the beast have been affected some days before its illness had been noticed, three or four applications daily will be requisite.

For the Feet. or

Socotrine Aloes	...	1½ oz.	Calverts Carbolic Acid	4 oz.
Rect. Sp. Vini	...	4 „	Sweet Oil	... 20 „
Alum	...	½ „		
Water	...	8 „		

Dissolve the aloes in the spirit and the alum after powdering in the water and then mix.

Apply twice a day between the claws for mild cases, and three or four times for severe or neglected ones.

Suggestions as to treatment, food, &c. &c.

Immediately upon a beast becoming affected (which may be easily known by daily inspection, when grazing or when fed in the stockyard, the affected beast appearing listless and disinclined to feed, head generally drooping and a slightly frothy saliva flowing from the mouth) it should be isolated from the herd and treated at once.

This disease being very infectious, a close watch should be kept upon the remaining cattle for some days after the infected beasts have been detected.

A separate attendant should be deputed to attend upon the sick cattle, and must on no account be permitted to go near the remainder of the herd. As it would be impossible for him to administer the medicines without some of the beasts' saliva (the virus of infection) falling about his clothes, he should be made to change them when he may have occasion to leave the hospital, and he should always wash his hands in some disinfecting fluid (a weak solution of Calvert's carbolic acid is the best) care should also be taken to keep dogs away from the hospital as they moving amongst the litter would likely carry the infection to the stockyard.

From the soreness of its mouth the beast, however, much inclined, will be unable to eat any thing but the smoothest gruel or something of that nature. The best thing to give in India until the mouth becomes somewhat healed, is rice boiled down to a thick *congee*, with a little *goor* mixed with it, no salt should be given on any account.

Water should be supplied freely as the beasts appear to suffer much from thirst.

Whenever medicine is given the nozzle and legs should be washed with a weak solution of carbolic acid about one part of acid to twenty of water.

Should aloes and sp. vini, not be easily procurable the sore on the foot should be treated with a mixture of one part of carbolic acid to five parts of oil.

My experience leads me to believe that the sore between the claws is only sympathetic, many cases occur and some very severe, without any sore upon the feet, but in no instance does the sore appear on the foot unless accompanied with affection of the mouth, moreover the sores on the feet invariably disappear as the mouth heals.

After the disease has disappeared all utensils, ropes, litter, &c. &c., should be burnt on the site of the hospital together with the materials of the shade or hut under which the cattle have been tethered, thus preventing infection, and also disinfecting the ground upon which the sick beasts have been stalled.

As every thing used should be destroyed only cheap vessels such as common earthen pans, wooden buckets, &c. need be procured for hospital use.

3rd May, 1880.

Report on the elasticity and strength of Eucalyptus and certain other N. S. Wales timbers. Communicated by MR. C. F. CRESWELL.

IN your Society's journal for 1877, which I have only lately received, I read "the cultivation of the *Eucalyptus globulus* and other Australian gums in India." With the exception of two or three varieties, however, the above treats of the *E. globulus* only, and I am not surprised to find the blue gum fail, at least in the warmer districts of India. You must remember that though *E. globulus* is found in Victoria, say 35 degrees south, there is no seed collected so far to the north, as the trees neither grow so luxuriously nor in such forests as are to be found in South Tasmania. Most of the blue gum seed that is collected is taken by my Hobart Town house, the only seed house in that city, and I supply all the colonial seedsmen, Baron von Mueller, and the colonial Governments with all the seed they require, and I can safely say nine-tenths of the *E. globulus* seed is obtained to the south of the 43 degree.

There are many other varieties of *Eucalyptus*, however, indigenous to our very hot colonies, say between 30 and 15 degrees south, that we consider as valuable here as *E. globulus*, that would, I believe, succeed on your hot plains, and I pur-

pose sending you several varieties for trial, except *E. rostrata*, *marginata* and *sideroxylon*, which I see you already have; also *citriodora*. Of the varieties sent I take extracts of the timber value from a work of Mr. Ch. Moore and from other sources.

I shall be happy to hear, when seasonable, what varieties succeed and shall be glad to supply seed of such in quantities. The value of the seed is various, say from 15 to 50 pounds. *E. globulus* I am supplying at present at 10 to 12 pounds.

MELBOURNE, 30th March, 1880.

Result of experiments on elasticity and strength of New South Wales timber conducted at Royal Mint, Sydney. The timber consisted of bars 5 feet long and 2 inches square, placed horizontally on supports 4 feet apart. .

	Specific gravity.	Breaking weight in pounds.	Deflection in inches.	Common names.
<i>Eucalyptus capitellata</i> ..	·922	1512	2 3	White stringy-bark.
<i>E. Sieberianna</i> ...	·964	1204	1 97	Mountain-ash.
<i>E. saligna</i> ...	·989	1680	2·45	Grey-box.
<i>E. haemastoma</i> ...	1·080	1204	2·03	Blue-gum.
<i>E. rostrata</i> ...	·942	1372	2·09	Red-gum.
<i>E. pilularis</i> ...	·990	1232	2·92	Black-butt.
<i>E. piperita</i> ...	·897	840	1·83	Peppermint wood.
<i>E. tereticornis</i> ...	1·131	1439	1·43	Bastard-box.
<i>E. sideroxylon</i> ...	1·167	2034	2 45	Ironbark.
<i>Angophora lanceolata</i> ...	·913	933	1·87	Apple-tree gum.
<i>Tristania taurina</i> ...	·903	1330	1·75	Turpentine tree.
<i>Acacia decurrens</i> ...	·729	1148	2·5	Black Wattle.
<i>A. dealbata</i> ...	·717	1549	2·35	Silver Wattle.
<i>Grevillea robusta</i> ...	·564	· 728	...	Silky-oak.

Castanospermum Australe.—Magnificent tree 130 feet with 4 to 5 feet diameter: the timber dark, prettily grained, not unlike walnut; used for cabinet work, for which purpose it is well suited, and is sometimes split for staves.

Eucalyptus goniocalyx.—A large tree which should be included amongst those for new plantations. Its wood resembles that of *E. globulus*. For house-building, fence-rails and similar purposes it is largely employed in those forest districts where found, and is a valuable timber.

Calophylla more umbrageous than most *Eucalypts* and of rapid growth. The wood is preferred to *E. marginata* for rafters, spokes, &c. It is strong and light, but not lasting underground.

Eucalyptus luehmannii.—New variety not described.

Eucalyptus pitularis. *Black-butt*.—One of the best timber yielding trees about Sydney, of rather rapid growth. It is much used for flooring.

Angophora lanceolata.—In some situations attains a height of 80 to 100 feet, and a diameter of 3 feet, timber very variable in quality when free from gum-veins, much used for naves of wheels and other purposes.

Tristania laurina.—Magnificent tree 150 to 200 feet with 5 to 6 feet diameter, with great length of bore, timber valuable for fences, posts and piles; very durable under ground, and said to resist the “teredo navalis” in salt-water.

Eucalyptus saligna.—A tree reaching a height of 100 to 150 feet, and a diameter of 3 to 4 feet. Timber in high repute for various purposes.

Eucalyptus botryoides.—A very fine tree from 100 to 160 feet high, considered one of the finest timbers for ship-building.

Eucalyptus lacmastoma.—A very large tree from 100 to 160 feet high, and a diameter of 4 to 5 feet; considered one of the finest timbers for ship-building, and very much used for wheelwright’s work and other purposes.

Eucalyptus tereticornis.—A tree of 80 to 150 feet high, and a diameter of 3 or 4 feet, an excellent timber, much used for plough-beams, poles and shafts of drays and carts, spokes of wheels and ship-building.

Eucalyptus polyanthemus.—A tree of frequent occurrence and moderate size; timber used by wheel-wrights for naves, felloes, and spokes.

Eucalyptus corymbosa.—A fair sized tree; timber subject to gum-veins but durable; used for posts and rails.

Eucalyptus capitellata.—A large tree; timber much prized for strength and durability, excellent for house carpentry.

Eucalyptus piperita.—A tree reaching 80 to 150 in height, and a diameter of 4 to 5 feet, much larger in southern districts; bark more or less deciduous; timber used for various purposes.

Notes on the preparation of the Rhee fibre by certain residents of the Bhaugulpore District. Communicated by the Government of Bengal.

From A. MACKENZIE, Esq., Secretary to the Government of Bengal, General and Revenue Departments, to the Secretary to the Agricultural and Horticultural Society of India.

Miscellaneous.

Fibro.

Letter from Messrs. Burrows, Thomson, and Mylne, No. 3284, dated 8th April, 1880.

Letters from Ditto, dated 19th and 20th September, 1879, to the address of the President of the Rhee Committee, Saharanpore.

I am directed to forward herewith a copy of the papers noted in the margin, together with the sample of Rhee fibre referred to therein, and to say that the Lieutenant Governor would be glad if he could be favoured with the opinion of the Society as to the commercial value of the fibre, and its suitability to the Indian and home markets.

2. The return of the sample is requested with your reply.
Darjeeling, 21st June, 1880.

LT.-COLONEL H. H. STANSFELD, Private Secretary to the Lieut.-Governor of Bengal.

In reference to the recent competitive trials at Saharunpore of machinery for extracting the fibre of the Rheea plant, it may be interesting to His Honor the Lieutenant Governor to know that the fibre has been prepared many years ago at Bhāgulpore by some families of the Dhanook caste for the silk weavers there.

We were aware of this, and at the time of the recent competition sent to the President of the Government Committee, sample of Rheea fibre prepared by the Bhāgulpore method with a description of the process.

It was also suggested that this process might be beneficially carried out by the female members of poor Rajpoot and Brahmin families who are not allowed to appear in public or engage in field work. There are great numbers of such families whose women have literally nothing to do.

Clean Rheea fibre brings high prices in Europe, and is valuable as compared to its bulk.

The plant is perennial and the cultivation similar to that of sugar cane without the labor and expense of yearly planting. The roots properly attended to will give three or four cuttings yearly in this part of the country. If left in the open field cattle don't graze it. These are desirable qualities in the estimation of Rajpoot and Brahmin cultivators.

We have procured roots from the Saharunpore and Calcutta Government gardens, with the intention of doing what may be possible to introduce a valuable industry among the Rajpoot and Brahmin families resident in the villages of the Jugdispore Estate.

A small sample of Rheea fibre from plant grown here and prepared by the Bhāgulpore process is herewith enclosed for the inspection of His Honor the Lieutenant Governor.

Jugdispore Estate, Beheea, 8th April, 1880.

The method for obtaining this fibre practised by certain natives of Bhaugulpore of the Dhanook caste, some eight or ten years or still further back is generally as follows :—

The site of the little factory is chosen if possible near a stream of soft water, as the process is one of slow boiling or simmering, and beating in combination with washing.

The factory plant is an earthen or other pan or boiler, and two notched boards such as dhobies use.

The work people, two men, two women, and two boys.

The boiler is charged with water sufficient to cover the shoots proposed to be dealt with, and to it is added about 10 chuttaks *sujjee matre* for maund of plant placed in the boiler, the whole is then allowed to simmer or boil slowly for 1½ or two hours.

The shoots are then taken by or handed to the nearest man with a notched board before him, (the boards being placed near by or partially in the water dhobie fashion) in such portions as can be held firmly between his two hands he continues to dash it against the board washing it at the same time thus clearing each end alternately of the wood and portions of the bark and gum. The handful is then passed on to the second man with a similar board who beats and washes it in the same way to free the filaments still farther from gum and bark.

After this it is taken by the boys back to the boiler to be again slowly boiled or simmered for about an hour. It is then again beaten and washed by the two men as before till the gum is removed, and the filaments are free.

The two women now take charge of it to be dried, beaten and drawn or carded till it is in the condition of the accompanying sample but much whiter.

A maund of shoots per hour can thus be easily worked off, which if filament is in the plant in the proportion of 2½ per cent., will be one seer of fibre fit for spinning by the native hand method or for the cording machine if sent to Europe.

If the percentage of filament in the plant is over $2\frac{1}{2}$ per cent. the outturn will be increased in proportion while no addition is made to the cost.

By adding half the original quantity of *sujjee matee* to hot-water in the boiler it may be used again afterwards, the water should be changed.

We propose introducing the domestic cultivation of the Rheeā plant, and preparation of fibre, to the people of the villages on the Jugdispore Estate, in the hope that it may make a considerable addition to the family earnings, especially to high caste families whose women are as a rule *purdā nashin*, and to whom it seems the preparation of the fibre would be a profitable means of passing time otherwise useless. The plant being perennial and hardy would require little care from the men beyond perhaps loosening the surface and weeding every two months, and giving some manure twice yearly.

Should any simple machine be required or found to be beneficial we have reason to believe that the want will be met by two small rollers on the principle of the native *chirkee* or cotton gin roughed on the surface, and working at different degrees of speed; this has been found to loosen and partially remove the bark and to some extent freeing the filaments from the gum or gluten by the drawing or trilinear motion of the rollers so adjusted to each other.

(Sd). THOMSON & MYLNE.

SAHARUNPORE, PERCY HOTEL, }
20th September, 1879.

E. C. BUCK, Esq., c. s.,

President of the Rheeā fibre Committee,

SAHARUNPORE.

In addition to our memo. on Rheeā fibre handed to you yesterday, we will be glad if an opportunity can be given during November or December next of testing on a reasonable large scale the Bhaugulpore method of preparing Rheeā

fibre, at or near the Botanic Gardens, Calcutta, where we believe a considerable quantity of Rhea plant is grown. •

Report by Mr. W. H. Cogswell, on the above specimen.—I consider this sample of Rhea to be one of the best that has been submitted to me for a long time past, as regards its color, cleanliness, and soft silky fibre, and its comparative freedom from gum and mucilaginous matter. The fibre has not been destroyed by chemicals, as is so frequently the case in many processes, and, I think, but very little injured or weakened in its strength under the simple method said to have been adopted in its preparation. It is excessively short, owing, I think, to excessive hackling or combing, and a great waste must have been the consequence. Its value in consequence will be materially lessened. It is, however, admirably adapted for spinning, and I would recommend that in the absence of spinning and weaving steam machinery, a sample of cloth be prepared by hand. It is, beyond all doubt, of great commercial value in Europe for blending with silk fabrics, and I advise that a good large sample be sent to England to be properly and carefully valued, which I think it is quite impossible to arrive at in this market.

Note by Mr. S. H. Robinson.—I agree with Mr. Cogswell's remarks; but before sending the sample to England for valuation in the home market, I think Messrs. Thomson, Burrows, and Mylne might be asked at what rate it is usually sold in the Bhaugulpore district, and the rate quoted to the English dealers to whom it is proposed to send the sample.

Remarks on Rhea cultivation and preparation. BY T. SANDYS, Esq. *Communicated by the Government of Bengal.*

I reply to Messrs. Burrows, Thomson, and Mylne's No. 2488, dated Beheea, 30th June last, addressed to the Secretary to the Government of Bengal, General and Revenue Department, copy of which I am favored with under your Office

Memo: No. 234 G. of yesterday's date. I beg to state that I know nothing of the Dhunook party, now said to have removed to Synthia; and whom perhaps you will be able to discover by making enquiry in that quarter.

2. For more than sixteen years past I have kept up a small cultivation of Rheeā for experimental purposes only. Altogether I have followed out above a dozen experiments eventually discarding them all for one. During this long period the various processes have been generally made no secret of though there are portions I have kept in my own hands. They have been manipulated by various work people and are known to many. Plants may or may not have been surreptitiously obtained from my cultivation, as I took no particular precaution in this respect.

3. I began with about 100 cuttings obtained variously from Chowringhee, Purneah, Dinagepore and Rungpore. Eventually there being no particular difference in the outturn of these plants they all got mixed up together.

4. I have met with great reverses in the cultivation, the difficulties of which I regard as secondary if not equal to those of the extraction of the fibre. Nothing but the highest state of garden cultivation will answer. Will this pay? I think it will, provided that an economic organised system is pursued from the planting of the cutting until the fibre is woven into cloth, not otherwise. I cannot speak positively on this point, as it has not been worth my while to try it as yet on a proper scale. I have confined myself mostly to hand work, though machinery may be largely employed at various stages. Life spared, I may follow it up two years hence when more at liberty. In the meantime I have been watching for the discovery of any better process than my own. Satisfied on this point, I am ready to reject my own.

5. Rheeā from the character of the plant must be grown on high lands in contradistinction to submerged lands. Hence, as a rule high lands will always be of a poorer

description than low lands; whilst it is always on the latter that white ants prevail the most. I purposely selected some high calcareous land abounding in kunkur to see what would be the outcome of a poor soil. The first two to three years the plant succeeded pretty well, but after this period the white ants seem to have discovered the stranger for the first time. After harvest cuttings they attacked the woody portion of the stem, thus left exposed, and burrowed downwards inside the roots, completely honey-combing them of their pith, leaving nothing but the bark untouched. They eventually attacked all weaker plants of all ages. I persevered several years sometimes losing two-thirds of my crops, until wearied out I removed the remains into a well manured plot in the garden, where they at once recovered themselves, became healthy plants and have given good produce.

6. Whenever convenient to you I shall have much pleasure in showing you this plot, and present you with a ripe plant entire which you can send down to Dr. King by the night train, and it will reach him the next morning quite equal to retransplanting, and which will be more complete than a supply of leaves only. Annexed is a photograph of one of my oldest plants which escaped the white ant outrage. I did not observe that the calcareous soil was particularly detrimental to the plant. Its roots pierced to considerable depths, and I have actually found roots growing through crevices in the kunkur nodules themselves.

7. Through the Imperial Government I offered to make my processes known at the late Saharunpore trial, and I sent on three samples of its cloth roughly woven; still retained, though that is immaterial as my later process is an improvement. The Committee did not accept my offer. I could not compete under the conditions of the advertisement. My processes are not immediate, but require time, though it does not necessarily follow that they must therefore be rejected as expensive. My many years experience goes to show that

any violent rapid extraction of the fibre is injurious to its strength. The fibre can be brought out white and silky in its green state, in a few hours, but very much entangled and ruined.

8. Enclosed are two samples of $\frac{1}{2}$ and 1 inch tape according to my latest process, spun and woven by a common village weaver with his rude implements. I shall be very glad to communicate my process to any one who will put me in possession of a better one.

Experimental cultivation of Bahmich Cotton in India. Communicated by the Government of India.

From C. L. TUPPER, Esq., Offg. Under Secy. to the Government of India, to the Secretary, Agricultural and Horticultural Society of India, Simla, the 28th July, 1880.

Home R. and A. Dept.

Agri. and Hortl.

I AM directed to forward for the information of the Society copy of a collection of papers and of a note regarding the experimental cultivation of Bahmich Cotton in India, and to state that the Government of India will be glad to receive a report on the results of the experiments made with the 12lbs. of genuine Bahmich Cotton which it is understood was supplied to the Society in June, 1878.

Bahmich Cotton.

This new species of cotton is said to have been discovered by a Copt living in the upper part of the Nile delta at a place called Birket-el-Sab, a station on the Cairo Railway, in the province of Menufie, in 1873. The Copt noticed a cotton plant wholly different to the rest. He collected the pods, separated the seed, and carried on the cultivation secretly for three years before attention was drawn to the plant.

This variety, it is believed, is a cross between the ordinary cotton (*Gossypium vitifolium*) and Bahmich (*Hibiscus esculentus*), known in India as *bhendi* or ladies' fingers.

The following translation of a description of the plant, which appeared in a French paper published in Egypt, is taken from Mr. Robertson's report on the Sydapet Experimental Farm for 1877-78:—

“It is possible that this new variety may be the result of a cross between the *Hibiscus esculentus* and the ordinary cotton plant. It is further a most interesting plant, because it yields much more heavily than the ordinary cotton. The growth is more upright than that of the ordinary cotton (*Gossypium vitifolium*). It has a straight unbranching stem, in this respect differing from the latter plant, which is of shrubby form with numerous branches, themselves again branching and producing irregularly at their joints a bole of cotton. On the contrary, in the Bahmie cotton plant the stem is straight, taller and unbranched, excepting, perhaps, a few small branches at its foot. The bolls grow in clusters of two or three at the axils of the leaves.”

A further account of the plant by Mr. Henry Carcas, of Birket-el-Sab, taken also from the same report, is as follows:—

“The new cotton plant grows to the height of 8 to 10 feet on one vertical stem without any horizontal branches, with very few leaves, and gets covered with a quantity of cotton buds. As much as eighty have been gathered from one plant. It happens, however, but not as a general rule, that one or two sprouts are often seen shooting off the stem within three to five inches from the ground growing vertically alongside the mother plant, but never acquiring a full development nor yield: consequently they should be considered as parasites and ought to be suppressed in proper time. The absence of branches allows the plants to grow comfortably very close together; and as much as four plants can be allowed to grow in a square foot of land.

“Its origin remains unknown, but evidently is a matrimony between hemp and cotton. The Arabs being in the habit of planting round their cotton fields a small strip of hemp, the phenomena must have originated from the ‘pollen’ of either of the two plants having been carried by the wind or bees from one flower to the other.

“It requires no particular mode of treatment from the ordinary cotton plant.”

“Mr. Robertson's own observations on the plant are the following:—

“This new variety is said to be a spontaneous cross between the *Hibiscus esculentus* and the ordinary cotton plant, both of which

belong to the same family. It is a very unusual occurrence for two species of plants to hybridise in this way. In general appearance the new plant resembles closely the *Hibiscus*; the stem is perfectly straight; it is almost altogether without branches; and the cotton bolls like the seed pods of the *Hibiscus* are placed on short stems around the main stem.

* * f * * * * *

“The new variety appears to possess these advantages: it is prolific in the yield of lint; the lint is of good quality; the produce appears to come altogether; the plant occupies a small area of land; and from the absence of branches the tillage of the soil during the growth of the plant can be efficiently performed.”

The following is an account extracted from a report (given in full as an appendix) by M. Delchevaërie, First Inspector of the Department of Agriculture and Commerce in Egypt:—

“The new species of cotton which was found some time ago to occur in the Menufie, and which among the Natives is now known as the Bahmieh cotton plant, has straight stems, the tallest of which attain a height of three *mètres*, and, instead of throwing out lateral branches, produces two or three semi-verticillated pods issuing directly from the axilla of each leaf, these being alternately arranged around the stems.

* * * * * * *

“The leaves of the Bahmieh cotton are large, greatly undulated, and of a deeper green than those of the ordinary cotton. Its flowers are yellow, the interior spotted with purple, somewhat like those of the ordinary cotton, but they are frequently larger sized, and grow on elongated peduncles.

“As to its origin, it is thought that the contract of Bahmieh plants which existed in the cotton plantations of Birket-el-Sab, having produced this new type, acted upon the seed of the cotton plants at flowering time, and that the origin of this species may therefore be attributed to a process of hybridisation between the Bahmieh (*Hibiscus esculentus*) and the ordinary cotton (*Gossypium barbadense*), the more so that, when seen from a distance, the plantation of this new cotton display, like those of the Bahmieh (*Hibiscus esculentus*), a multitude of high, straight stems without branches, at least as regards three-fourths of their length from the tops.”

In March 1877 six seeds of this variety were sent by Dr. Birdwood, of the India Office, for experimental cultivation, with a view to the introduction of the staple in India. The seeds were sent to the

Superintendent of the Bhadgaon Farm, in Khandesh, for careful cultivation. They, however, lost their vitality before reaching the farm and did not germinate. The Agent and Consul General at Alexandria was then asked to send three pounds of the seed. In the meantime the Secretary to the Agricultural and Horticultural Society of India, attracted by an account which appeared in the *Times* of the merits of this variety of cotton, and its extraordinary productiveness, obtained from Mr. J. C. Chapman, Agent of the P. and O. Company at Alexandria, some seed. The packet of seed was received in June 1877, and was distributed in small quantities to residents in various parts of India, including fifty seeds sent to the Government of Bengal and twenty to Mr. Buck. The result of these experiments, so far as known, will be noticed before an account is given of those made with the seed obtained by the Government of India from Egypt.

In the Society's garden at Alipore the seed was sown in the middle of June 1877. The plants grew vigorously to a height of ten feet; began to blossom in September; yielded the first ripe pods in October and November; and continued flowering and podding till the end of February 1878 and sparingly during March. At the end of April 1878 they recommenced to flower, and Mr. Blechynden proposed to allow the plants to remain as biennials, to ascertain if the quality of the produce would retain its character or deteriorate. The result will be referred to later on.

The seeds sent to Mr. Buck by the Society were made* over to the Superintendent of the Cawnpore Farm where they were planted on garden land, in ridges 2½ feet apart from each other.

* Some seed, it would appear, was sent also to the Lucknow Horticultural Gardens

They were sown, on the 19th July 1877: out of twenty sown, thirteen germinated. The first bolls were picked on the 20th December, and picking went on till the beginning of March 1878. The amount of uncleaned cotton collected from the thirteen plants was 5lbs., in the proportion of about three parts of seed to one of cotton. The season is said not to have been a good one for the plants, owing to almost a total cessation of rain. They grew to a height of 5 to 5½ feet and threw out long lateral branches.

Mr. W. Masters, of the Opium Department at Hadjeeppore, also planted a few seeds on the 7th July 1877. The plants commenced flowering in the beginning of October and podding in the beginning of December. His plants also had lateral branches, and grew to a

height of 10 to 12 feet. Of the seed supplied to the Government of Bengal, no account can be found.

Messrs. Haworth & Co., of Calcutta, reported as follows on the specimens from the different experiments above referred to:—

(1) *Cawnpore Experimental Farm*.—Boles similar to Egyptian cultivation and like it as regards seed, both as to formation and freedom with which the fibre can be separated.

(2) *Cawnpore Experimental Farm*.—Not of a particularly good colour; but as regards length, softness, strength and fineness of staple, everything that could be desired, and would rank as good fair, Egyptian cotton, valued at about 7 to 7½ per pound.

(3) *Mr. Masters*.—Not equal to No. 1 either in size of the bole or the quality of the cotton, but similar in all other respects.

(4) *Mr. Blechynden*.—Equal in color to No. 2, but containing considerably more stains, harsher in staple, which is also wanting in length and strength; value about 6 to 6½ per pound.

Further reports on the samples from the Cawnpore Farm were given by the Manager of the Elgin Mills at Cawnpore and by Mr. Kapp, of the firm of Messrs. Volkart Brothers, Bombay.

The Manager of the Elgin Mills said:—

“With reference to samples of Bahmieh cotton forwarded for opinion, I have to state that, so far as I am aware, there is no machinery in India capable of working cotton of so long a staple.

“Such cotton is used in England for counts ranging between 100s and 200s, and requires peculiarly delicate machinery.

“Its probable value in England would be 1s. per pound.”

Mr. Kapp reported on the cotton as follows:—

“After examining the sample of cotton carefully, I have come to the conclusion that the nearest comparison in appearance and touch to it is fully good, fair, brown Egyptian cotton. The staple is silky, but very irregular and very wasty, which deficiency would debar this style of cotton from being mixed together with Egyptian, or used separately for high numbers. Besides the irregularity in the staple, there are very objectionable knots and nests in it, which reduce the value of the cotton. Taking into consideration that the price of Egyptian cotton is exceptionally high now, and fully good, fair brown being quoted about 9½d., I value the sample at 4d. below that class of cotton, say 9¼d. If the cotton has not been allowed to mature fully, this circumstance might account to some extent for the wasty staple; but even admitting that some of it has been picked in an unripe condition, the best of it would not be

worth more than 9½d., which would be equal to good brown Egyptian.

The report by Messrs. Haworth & Co. on the cotton produced the second year from the plants in the Agricultural and Horticultural Society's garden is given below:—

“The colour is very poor, which may be natural, but there is also much stained cotton. The staple, however, is capital, being long, strong and fine, and on this account alone the sample would rank as good fair Egyptian value about 8½ per pound. The seed is very similar to the ordinary Egyptian.”

The Secretary to the Agricultural and Horticultural Society said that his plants, though not so bushy as the ordinary Egyptian or other exotic kinds, were not of such a spare habit as has been represented; and the reports from Cawnpore and Hadjeeppore say that the plants had lateral branches. It is possible that the seed obtained by the Agricultural and Horticultural Society in 1877 was not pure Bahmieh seed, but probably the ordinary Egyptian cotton, or largely adulterated with it. Adulteration was doubtless largely practised at this time, owing to the high prices the new variety fetched in consequence of the excessive demand for it.

With reference to the favourable report by Mr. Kapp above quoted on the Cawnpore sample, the North-Western Provinces Government was asked to instruct the Director of Agriculture and Commerce of those provinces to continue to give his attention to the cultivation of this variety of cotton with a view to determine whether it could be grown in Upper India without any very material increase in the cost of cultivation. The difficulty expressed by the Manager of the Elgin Mills at Cawnpore, as to the want of machinery to treat such a long staple, the Government of India were of opinion could be easily overcome.

The seed produced at Cawnpore and Lucknow was distributed to the Manager of the Elgin Mills, Cawnpore, and the Deputy Commissioners of Jalaun and Lalitpur, but did not succeed. At Lucknow the experiment was continued, but it was found that the seed had much deteriorated and gave little or no result in 1879.

The Agricultural and Horticultural Society were supplied in June 1878 with 12 lbs. of genuine seed, and it would be interesting to know the results of the experiments of this fresh supply.

The 3 lbs. of Bahmieh cotton seed asked for by the Government of India was received from Egypt in February 1878 and distributed equally to the Governments of Madras, Bombay, the North-Western

183 *Experimental cultivation of Bahmieh Cotton in India.*

Provinces and Oudh, and the Central Provinces, for experimental cultivation at the Government Farms.

In Madras the attention of the Superintendent of the Sydapet Farm had been attracted to the reported excellencies of the Bahmieh cotton before the receipt of the seed sent by the Government of India, and several experiments were made by him to grow it, but with uniform ill-success. The plants were found to yield little cotton.

At the Bhadgaon Farm, in Khandesh, the experiment was a failure. The following is Mr. Stormont's report on the results:—

“The $\frac{3}{4}$ lb. of fresh Bahmieh cotton seed received under Government Resolution No. 1257 of 9th March 1878 was duly sown, partly in a piece of rich black ground, and partly in a light free loam resting on open *murrum*. In the former case the seeds were planted out in lines, 4 feet apart and 4 feet also from plant to plant. About three quarters of the whole germinated and the plants made good progress, reaching heights varying from 6 to 8 feet; they unfortunately came in flower much too soon, which were beaten to the ground by the pelting rains. Many of the trees subsequently failed, owing probably to excess of moisture at their roots; the remaining plants yielded only a few pods each and died back to the root, from which, in a short time, a fresh growth of shoots was produced. These, in their turn, yielded a crop of pods, which, however, were so very much worm-eaten as to render the cotton next to worthless.

“The plants grown in the light land, especially a few in the partial shade of some Divi-Divi trees, produced, on the whole, much better results. They took longer time to mature, and grew up with a clear stem to as much as 10 feet high. They have never been at any time richly furnished with pods, but have kept on yielding slight monthly pickings, and from all appearance will keep on doing so for another year to come.

“Several small parcels of Bahmieh seed were given away for trial, the result in each case being unsatisfactory.

“From all this it would seem that in Khandesh the soil is too stiff, and the sun-heat and rainfall too severe to admit of the plant doing its best. Aided, however, by the experience gained from last year's experiments here and elsewhere, I am hopeful that the plantation (about two acres) now being made will, under irrigation, prove more satisfactory.

"A bag of the cotton was exhibited at the last Agricultural Show at Mahiji, and was much admired by merchants and others. A sample sent to the Government of India was submitted for the opinion of the Bengal Chamber of Commerce, who formed a high opinion of it, considering it equal to Egyptian and the better quality of Brazils, and worth then 5½ per pound; this being much above the value of any description of Indian cotton, no method of cultivation should be left untried likely to lead to its introduction."

The report by the Bengal Chamber of Commerce, mentioned in the above extract, is as follows:—

"The staple is long and strong; the cotton is clean and very free from stain, and the colour and general characteristics are those which belong to cotton grown in Egypt.

"The Committee of the Chamber of Commerce are of opinion that if the quality were kept up to the sample before them, and spinners could depend on a certain regular supply, this description would in process of time come to compete side by side with Egyptian and the better qualities of Brazils in the home markets.

"It is very superior to any Surats yet exported, and till it becomes known and appreciated it is difficult to fix the value.

"The Committee think, however, they may roughly quote it to-day at Rs. 20 to Rs. 21 per maund, or to sell in Liverpool 5½ to 5¾ per pound."

The seed supplied to the North-Western Provinces Government was distributed to the Saháranpur Botanical Garden and to the Cawnpore and Allahabad Experimental Farms. At Allahabad the seed was sown too late, and the boles had not time to ripen before the frost set in and destroyed them.

At Cawnpore the cultivation was neglected.

But at Saháranpur the cultivation was conducted with care, and the following is Mr. Duthie's report of the results:—

"The seed was sown in pots on the 27th of May, the seedlings being transplanted to ridges of well-manured ground, each plant being 2½ feet apart from those round it. There were seventy-eight plants and the average height which they attained was 6½ feet. The number of boles on each plant averaged thirty after the removal of about one-third of the boles to strengthen the remainder. The plants maintained in a striking manner the peculiar upright habit originally observed in this variety when first detected in Egypt."

The Manager of the Elgin Mills, Cawnpore, considered the cotton produced superior to all other sorts of cotton grown in the garden, comprising New Orleans, Tree cotton, ordinary Egyptian, upland Georgian, Nankin and Hingunghat, and of excellent staple, strong and clear, would make very superior 100s to 130s yarn; value in Liverpool about 8d. to 8½d. per pound.

Mr. Duthie continued the cultivation of this variety in 1879, but the result was a failure. The ground having been too heavily manured, the plants grew to an extraordinary height, measuring between 10 and 15 feet, and ran to leaf instead of producing flowers. The plants, however, exhibited their characteristic habit of growth; but the cotton was reported by the Manager of the Elgin Mills to be inferior to the outturn from the imported seed, though the staple was still superior to the other varieties of cotton grown at Saharanpur.

The experiment in the Central Provinces also proved a failure. The seed was sown in the Nagpur Experimental Farm at the same time as the country cotton and germinated freely; but, as in Khandesh, the season was an unexceptionally wet one and interfered with the proper growth of the plants. Major Macdougall, the Superintendent of the Farm, thought that the plant would succeed better when sown (like the *gharri* cotton of the Chanda district) in September and irrigated during the cold weather. A few seeds given to the Agricultural and Horticultural Society thrived very well and yielded bolls from which seed was saved; but as all the plants branched out, Major Macdougall is of opinion that the true Bahmieh was not sent out. The Chief Commissioner said that the experiment would be repeated with the seed saved, and a further report is awaited from the Central Provinces on the subject.

The Punjab Government were supplied in the middle of 1878 with 6lbs. of seed from Madras, and that Government will be asked for a report of the results of any experiments made with it.

The following account of the experiments that have been made in the cultivation of this cotton in Texas is interesting:—

“The seeds were planted on 4th May in a garden situated in latitude 29° 40' at an elevation of 30 feet above Galveston Bay, and about 300 yards from its margin. The soil was a light, fertile, sandy loam. The seeds germinated, and the plants made their appearance above the surface of the soil in six days, namely, on 10th May. The first blossoms appeared on 8th July, and the first open fruits on 30th August. The average height of the plants was about 8 feet, but some grew up to 10 feet. After the plants had ceased growing, the

fruits perfected themselves, increasing in size. It is stated that the fruits are very abundantly produced from near the base of the plant to its very top. In the space of four months and ten days from the time of planting the open fruits were of sufficient size for picking in any quantity. From as careful and safe an estimate as could be made, the yield was found to be fully equal to 2,500 lbs. of cotton in the seed per acre. The habit of the plant is described as being very singular in its outline. Unlike the American upland and Sea Island cottons, it does not send off branches regularly from near the ground to the top of the plant; but the main stem bears close to the ground two, three, or more branches, and then rises to a height of 8 or 10 feet without a branch. Leaves only are given off along the stems, and in the axil of each leaf are from two to five, and sometimes six, long petioles each bearing a fruit. The branches described at the base were also very heavily fruited, as many as five large fruits growing so close together as to touch each other. The cotton or wool contained in every fruit on the plantation was of a pale yellow colour, which was difficult to be accounted for, as there had been no heavy rains during its growth to stain it. It is suggested the profuse dews may have been the cause. From the record of these experiments, it seems that we may still hear something favourable about Bahmieh cotton with regard to its becoming an article of commerce."

From the above account of the experiments that have been made during the past two years to introduce the Bahmieh cotton plant into India, it would appear that the results have been fairly successful and encouraging, and that it would be well to pursue the cultivation of a staple which has been, without exception, so highly reported on.

J. L. M.,—11-6-80.

Report on the Bahmieh cotton plant (*Cotonnier Bahmieh*) presented to His Excellency the Secretary of State for Agriculture and Commerce, by M. Delchevalerie, First Inspector of the Department.

THE new species of cotton, which was found some time ago to occur in the Menufie, and which among the Natives is now known as the Bahmieh cotton plant, has straight stems, the tallest of which attain a height of three *metres*, and, instead of throwing out lateral branches, produce two or three semi-verticillated pods issuing directly from the axilla of each leaf, these being alternately arranged around the stems.

The ordinary cotton plant, on the other hand (in its varieties, *Mako-Jumel*, *Gallini*, *Ashmuni*, &c.), has the form of a shrub with one or more main stems throwing out numerous lateral branches: these occasionally spreading out to a considerable breadth and bearing pods at various intervals, two, three or even four leaves often producing no pods from their axilla. The leaves of the Bahmieh cotton are large, greatly undulated, and of a deeper green than those of the ordinary cotton. Its flowers are yellow, the interior spotted with purple, somewhat like those of the ordinary cotton, but they are frequently larger sized, and grow on elongated peduncles.

As to its origin, it is thought that the contact of Bahmieh plants which existed in the cotton plantations of Birket-el-Sab, having produced this new type, acted upon the seed of the cotton plants at flowering time and that the origin of this species may therefore be attributed to a process of hybridisation between the Bahmieh (*Hibiscus esculentus*) and the ordinary cotton (*Gossypium barbadense*) the more so that, when seen from a distance, the plantations of this new cotton display, like those of the Bahmieh (*Hibiscus esculentus*) a multitude of high straight stems without branches, at least as regards three-fourths of their length from the tops.

If it be true that the new Egyptian cotton is the result of hybridisation between the two species above named, the fact is one of great importance to science, because in the annals of horticulture the process between species differing so widely is rare enough, and because such results as have been recorded down to the present time have generally remained sterile, or at best but of little use in the sequel; whereas in this case nature has produced a more fertile cotton than the ordinary kind.

During the past summer, at Ghezireh, we have, by way of experiment, artificially crossed the Bahmieh and the ordinary cotton, and the seed thereby obtained will be sown in the coming spring, and its growth watched during the summer season, in order to verify the theory and to ascertain whether the seed thus artificially obtained will produce the same species as the one found to occur spontaneously in Menufie.

On comparison with the ordinary kind, this new cotton has shown too great a difference to be accepted simply as a variety. If not a hybrid, it may very likely be an exotic species, introduced by chance into Lower Egypt.

Its origin, however, is after all a question more nearly concerning the scientific world than the cultivator. For the latter, the essential

point is the advantage it has over the cultivated kinds and varieties in producing pods at the axilla of every leaf, in addition to which the same area under the new species will permit of the growth of one-third more as compared to the old kind, that is, from nine to ten thousand plants per *feddan*.*

When duly improved by means of a rational method of cultivation, and by a judicious selection of the seed intended for sowing, the produce in cotton will steadily increase in quantity as well as in quality, for the Bahmieh cotton does not as yet fully develop its pods. We have especially observed that in plantations which, owing to close crowding of the trees, are insufficiently exposed to fresh air and light, a proportion of the pods remain abortive, notably, those situated about the lower part of the stems, and that the more elevated pods too, are somewhat slow in coming to full maturity.

The pods produced on the centre of the stems are usually the healthiest and most perfect. Hence it is only the seed from these which should be set aside for sowing in the following year, and it must therefore be carefully collected apart from the rest. Seeds from imperfectly developed pods, or from those growing on the bases and tops of the stems, or which have yielded cotton of inferior quality, as well as those picked from weakly plants, are only adapted for the production of oil and oil cake. By steadily adhering to this system, this valuable species will be gradually brought to perfection. The first plantations made of this new species were treated with tolerable care. The seed was collected carefully, and was sown by itself. The crop of the following year yielded a large number of plants, which were again planted separately, and during the past year considerable quantities of them have been cultivated in Lower Egypt.

This year all the large proprietors have cultivated the new species for which several hundred *feddans* have been taken up, notably in Shubra Kubbe, on the estates of His Highness the heir-apparent, and at Heliopolis near Cairo, &c.

In Lower Egypt some of these new cotton plants are said to have yielded from seven to eight *quintaux* of Bahmieh cotton per *feddan*, a result which might have been considerably improved upon if the seed had not been subjected to fraudulent admixture, and if, instead of planting *twenty thousand plants per feddan*, the quantity had

* The *Feddan*, containing 420 square *metres*, is usually made to bear from six to seven thousand cotton plants of the ordinary kind, and any overcropping beyond this would be incompatible with a rational method of cultivation.

been reduced to one-half of this number. There is no doubt that with a more careful treatment of the seed, as above indicated, the yield could be raised to ten *quintaux* per *feddan*.

During the past spring some clever speculators having bought Bahmieh cotton seeds from the peasants of Menufie, of whom they obtained them at low rates, afterwards succeeded in selling them at excessively high quotations to the large proprietors, even obtaining as much as thirty pounds sterling per *ardeb*; but, not satisfied with even this high price, they further increased their profits by mixing the seed of the new species, of which they had practically acquired the monopoly, to a considerable extent with seed of the ordinary varieties, owing to which all the planters have this year been grievously disappointed. We became aware of this practice last June, and immediately weeded the plantations under our supervision of all the *branched cotton* plants which were found to be growing intermingled with the *unbranched Bahmieh cotton* plant in order to prevent any degeneration in the new type. We strongly advise land owners growing *Bahmieh cotton* to plant it separately for the future, and as far away as possible from the ordinary kinds, so as to prevent any degeneracy in the new type.

Having thus removed all the country cotton plants which were found to be growing among the *Bahmieh* species, we obtained a pure kind, of which a portion, which in consequence of the weeding had more space around them than the rest, have produced as many as three or even four horizontal stems, still retaining, however, the character of the main stem, and producing pods in lieu of lateral branches. The new species is keeping up well, and we have reason to believe that it has been completely established after several years during which it has been already cultivated.

Many planters of Bahmieh cotton have, like ourselves, taken the precaution to weed out the branched plants which they found growing in their plantations of the new species. But unfortunately many of them have allowed the mixture of the two species to continue. Next spring it will therefore be necessary to take special care in the purchase of the seed of the new species, and to exact valid guarantees of its purity.

In the month of June and during the first fortnight of July the new species was attacked by a large hairy caterpillar, which caused considerable damage by eating the leaves and the tips of the young buds. Towards the end of July the caterpillar disappeared, and it

was impossible afterwards to find even one of them in the plantations.

Towards the end of summer, after the disappearance of these caterpillars, the small caterpillars which have now for a long time past ravaged the Egyptian cotton plantations, and for the study of which a commission under the presidency of His Excellency Sherif Pasha (of which we are a member) was appointed by the Home Office in 1871, made their appearance. This small caterpillar which attacks the American and Indian cotton plantations as well as those of Egypt finds its way into the pods, perforating the epidermis and feeding on the albumen contained in the seeds, and completely soils the fibre enveloping the seed.

Several entomologists, with whom we were in correspondence at this time, ascribe this caterpillar (the Egyptian variety) to the genus *Teuxis*. Dr. Boisduval described it in 1873 under the appellation *Euphaga gossypiana* and this learned entomologist recommends that the infected pods should be carefully cleaned of all caterpillars, and that *these should be burnt* so as utterly to extirpate the pest.

To the Secretary to the Government of India.

SIR,

On receipt of your No. 361, of the 28th July last, I addressed the majority of the applicants for the Bahmich cotton seed received by the Society in June, 1878. I regret to say but few replies have been received.

I annex copies of them; should any further information be received it will form the subject of a future communication.

The Photograph alluded by Mr. Westfield is herewith enclosed.

(Sd.) A. H. BLECHYNDEN,

Secretary, A. S. H. Society of India.

Calcutta, 6th October, 1880.

From Mr. T. Fernandez, Forest Department, Bhannugur Nathiawar, 13th September, 1880.—I am glad to tell you that this year's experiment with the Bahmich cotton is likely to prove successful. Some of the plants have already attained nearly 5 feet in height, that is 2 feet taller than last year's plants were in November when they suddenly withered. All

the plants are now in full bearing, and they look so vigorous that I cannot but think that they will escape the fate that overtook the plantation last year. In due time I will not fail to communicate the result of the present experiment.

From Mr. W. F. Westfield, Calcutta, 12th August, 1880.—For the information of Government I beg to report that the 'Bahmieh cotton seed you gave me I planted at my Tea Estate in the Dooars, but it proved almost a total failure, only 3 or 4 plants came up, and did not flourish. Of 2 or 3 seeds I tried planted here in Calcutta in flower pots, all came up vigorously, and from one plant, grown in a rather large gumlah, I gathered nearly $\frac{1}{2}$ lb of clean good cotton.

From the same, 24th August, 1880.—I have the pleasure to send you herewith another photo of the Bahmieh cotton plant grown on my terrace with some of the cotton and some of the pods, for your information.

From Dr. G. King, Royal Botanical Garden, Howrah, near Calcutta, 3rd August, 1880.—We only got a little seed and only some of it germinated. The plants grew fairly well for this part of Bengal. But there was never any demand for the seed, and I have really nothing to report. It is very little use having cotton tried in this part of the country where they are not at all at home as regards climate and soil.

From Messrs. Octavius Steel and Co., Calcutta, 30th August, 1880.—In reply to your favour of 5th current, we regret that, on account of the removal and illness of the Managers to whom this seed was sent in July 1878, we are unable to send you any information of value as to the result of the trials.

From Mr. J. Cameron, Superintendent, Botanic Garden, Bangalore, dated 14th August, 1880.—The enclosed extract from my annual report for 1877-78, records the first stage of our experiments with "Bahmieh cotton" and "Teosinte." Concerning the cotton, subsequent cultivation has not exhibited any remarkable results. Of the seventeen seedlings which were

raised from your seed, only five or six developed into healthy plants and comparatively these were small sized too. I was successful in raising seed from this planting, from which our stock of young plants has been increased for further experiment under more favourable circumstances. I should mention that the press of work in general prevented my giving special attention to the culture of "Bahmieh cotton" my aim being to increase the stock of plants rather than to test the quality of cotton.

The introduction of the *Euchlæna luxurians* has been very successful, and its forage appears to be appreciated.

Extract from the Lall Bagh ; report to Government for the year
1877-78.

Forage Grass.—On application to the Honorary Secretary Agricultural and Horticultural Society of India, I obtained a small packet of seed of the *Reana luxurians*, Syn. *Euchlæna luxurians*. This is a Mexican forage grass, and its merits were brought to notice by the above Society last year. In reply to a note of mine regarding the name of this plant Mr. A. H. Blechynden, the Secretary, writes :—

"Thank you for your note of the 23rd about *Reana luxurians* Syn. *Euchlæna luxurians*. There have been several notices about it in the Bulletin of the Acclimatisation Society of Paris, and Mr. Maudin sometime ago alluded to it being identical with *Tripsacum monastachyum*. Though it may have been known before, this does not invalidate its usefulness as a forage plant. The drawback to it as far as I have been able to ascertain is that it will not stand drought." Several dozen plants have been propagated from the packet of seeds introduced.

Egyptian Cotton.—I have also to thank Mr. Blechynden for the introduction to Mysore of another new product, *i. e.* "Bahmieh" or Egyptian cotton. The report that this new plant is the offspring of *Hibiscus esculentus* (Bindeki)

and the ordinary Egyptian cotton (*Gossypium* sp.) has not been authenticated I believe. These genera are nearly allied, but, it is questionable if the "Bindekai" could be the parent of an improved cotton plant. The 17 seedlings raised from the 20 seeds received, will be cultivated and reported on hereafter.

From Mr. W. H. Cogswell, Calcutta, 5th October, 1880.—I am sorry that I cannot give you a report to be very useful, such as I had intended, with reference to my trial sowings of the Bahmieh cotton seed that you gave to me, the fact being that I left for England and during my absence its cultivation was neglected.

The seeds germinated very readily, the plants became strong, healthy, vigorous and very full bearing, but contrary to my expectation, from the accounts I had read of its cultivation in Egypt, its habit was not spare. Without being thick and bushy, the stems threw out free laterals and the plants assumed a fair, though not very full appearance of foliage, without any approach to a long, thin growth.

I have some of the plants remaining which I am keeping as a biennial. The quality of the fibre is very good indeed, see sample herewith, being soft, long, of good strength, almost silky to the touch, somewhat creamy white in color, and fully bears out the report my firm (Haworth & Co.) gave you on your samples last year.

I am decidedly of opinion that it could be easily and well cultivated in Lower Bengal, and might be a success financially speaking.

Memorandum regarding Munjeet, Rubia cordifolia.

[A Member of the Society, resident at Berhampore, has addressed the Secretary regarding the above article in the following words:—

"Can any one connected with the Society give me some information regarding a plant called Munjeet (vern. Munjista.)

It is much used by native dyers as a substitute for madder, and like the latter gives fast colours. It is usually imported from Assam or Bhootan I am told, but so irregularly that at times (it is the case now) it is impossible to procure in Calcutta or elsewhere. Perhaps you or some Members of the Society might know whether the plant could be cultivated in Lower Bengal and the mode of culture it requires? Are there any specimen of this plant in the Society's Garden? If the attention of the tea planters of Assam, Darjeeling, or of other hill stations was called to the usefulness and mercantile value of the plant they might introduce it in their garden. I hear it is now exported from Calcutta."

As enquiries for information regarding this and other products are frequently made, it is thought desirable to introduce the following memorandum in the Journal by way of record, as probably very few of the Members have access to the earlier volumes in which papers on the subject have been published. In acknowledging its receipt the Member to whom it is addressed adds—"Pray accept my best thanks for the most interesting and useful particulars this memorandum contains. We use munjeet regularly here for silk printing, but as it is imported very irregularly from up-country we remain months without being able to procure some; hence my wish to enquire whether it could not be introduced in the plains; but I see it is out of the question."]

Among the various vegetable products of India which possess dyeing properties, there are, perhaps, few more neglected in every way than the munjeet, considering that it has for so many years formed an article of commercial export to a limited extent. This plant, which is frequently called Indian madder, is the *Rubia cordifolia* of botanists, and is a distinct species from the *Rubia tinctoria*, which produces the madder of Europe. An opinion was formerly entertained that munjeet was indigenous to Purneah, and other contiguous

districts of Bengal, and that it was solely from these localities* that our market was supplied with the article. It is, however, now generally known that Nepaul is the great producing country of this plant; it is also found in Darjeeling, and, indeed, throughout the entire range of the Himalayas, as well as in various part of Upper Assam. In some of the earlier numbers of the Journal, old series, there are several interesting communications in 1845, regarding munjeet, from the late Dr. A. Campbell when resident at Darjeeling, from the late Colonel Jenkins, then Commissioner of Assam, from the late Sir Henry Lawrence, then Resident at Nepaul, from Sir Wm. Sleeman, and others. These communications were the result of enquiries made by the Society, regarding the mode of cultivating and preparing munjeet in the localities where it is principally grown, with the view of ascertaining if, by a better mode of culture and a more careful preparation, the quality of the article could be sufficiently improved to enter into a closer commercial competition with the madder of Europe. The plant, when cultivated, is raised from seed as well as from cuttings, and thrives best at elevations of 4 to 5,000 feet, so that it is almost hopeless to expect it to succeed in Lower Bengal. The cultivated plant is the richer in dye, but the wild one also yields a good dye, but less in quantity. Munjeet it may be remarked, by the way, is the drug used in India, from time immemorial, for topical dyeing upon silk cloth, especially the Cossimbazar handkerchiefs, called *chappas*, in which it produces many shades of red, from a pale pink to crimson, a variety of brown and chocolate hues, and every shade between light purple and deep black. It does not fix so readily on wool or cotton as on silk. It was remarked by the Jury at the Great Exhibition of 1851, that some of the colours dyed with munjeet, are quite as permanent as those dyed with madder and even more brilliant.

The export of munjeet from Bengal was very fluctuating in former years, ranging from 12 tons to 6 or 700 tons.

During the official year 1879-80 only 6 tons of the value of 1,060 Rs. were exported. In the eight months of the current year 12 tons of the value of Rs. 3,151 were exported. All went to New York. The increased use of aniline dyes has led to the decline of the trade in madder roots, and a corresponding decrease in the export of munjeet. The total growth of madder was calculated a few years ago to amount to 47,600 tons of a value of over two millions sterling. The value of that used in Great Britain in 1874 was under £800,000, in 1875 only 4,11,000 and in 1876 but £2,39,000.

We learn from "Simmonds Tropical Agriculture" that the Industrial Society of Mulhouse, France, recently published a report on the effect of the introduction of artificial alizarine upon the consumption of madder. "The employment of the former product is constantly augmenting, and it is manufactured on a large scale in Alsace, Germany, and Russia. It is believed, however, that the large demand will not greatly affect the normal consumption of madder; or, in other words, the proportion of pure madder used in the arts, before the introduction into commerce of extracts of madder, will remain unchanged. It is with these extracts that artificial alizarine comes in competition, but only to a certain extent, for while it produces violet shades of greater brilliancy and beauty, its reds are inferior. In order to completely replace madder, another principle of that material must be present in the artificial product, namely, purpurine, which furnishes fine orange reds, but of which at the present time even the chemical constitution is not definitely known. Hence it is considered that the best tints can be obtained by artificial alizarine and madder extract combined, employing the latter of the shade of red most closely approximating orange."

The great difference between the import in former years into Great Britain of madder and munjeet, may be partly attributable to the bulkiness of the article as compared with

its value, and the consequent heavy charge of freight. The only apparent means of remedying this, would be, if instead of shipping the munjeet in its natural state, it were to undergo a somewhat similar preparation to that given to madder by the Zealanders. If, for instance, it were to be first kiln dried, afterwards reduced to a powder, and then packed in good cases, it would not only lessen the freight, but would, probably, add to the value of the dye, by not subjecting it to so much atmospheric exposure.

An attempt was made many years ago by a Member of the Society then resident in Calcutta (Mr. Henley) who had paid much attention to certain of the vegetable products of India, to introduce the munjeet into Europe under more favourable conditions. He found it to yield, when submitted to similar processes, all the different products obtainable from the madder of Europe; such as for instance the substance *garancine*, or the colouring matter of the plant, simply combined with carbonized vegetable matter, and obtained by mixing gradually an equal weight of concentrated sulphuric acid on the powder, and then by washing out the acid thoroughly with cold water. It would appear that all the colouring matter of four tons of munjeet, as at present packed, might be introduced in the space of one ton, although in point of actual weight, it may be estimated that three tons of munjeet produce one ton of garancine. Mr. Henley's paper will be found in the eighth volume of the Journal of the Society. The specimens submitted by him were forwarded to the London Society of Arts who, however, failed to respond to an application for report thereon.

Note on the cultivation and preparation of Jute. By W. H. COGSWELL, Esq.

[Messrs. Peel Jacob and Co., Merchants of this city, addressed the Secretary, under date the 2nd December, 1880, as

follows: We have received the enclosed letter from Messrs. Behre and Co., of Singapore, and not possessing the technical knowledge to enable us to reply to it, in a satisfactory manner, we have been induced to forward it to you and should feel obliged if you would inform us whether it comes within the province of your Society either to take the matter in hand, or to enable us to reply to the letter.

Copy of Messrs. Behre & Co.'s letter.—Not having had this pleasure for some time past we beg to profit of this opportunity to solicit your kindness in procuring us as full particulars as possible regarding the article Jute, as we wish to introduce the cultivation of this textile into Cochin China.

We would require to know—

The best kind of soil for Jute; the seasons in which planting and harvesting should be done and the time it takes to ripen. Whether the Saigon climate would not prove to be an obstacle to this culture, in having almost equal heat all the year round (from 70° at night to 95° at noon) with rains from May to November, and complete drought during the other six months. The approximate cost of Jute cultivation in India on a given space of land and the average yield of fibre for the same. The number of workmen required for such and their pay. Whether it would be possible for us to procure native workmen from your side, who are thoroughly acquainted with the cultivation and working of Jute. What sort of labour is necessary to prepare the soil. What machinery is necessary afterwards and which system is recognized as the best to work the fibre and to weave Jute cloth, and the approximate cost of such machinery. The whole course of proceeding from the planting to the harvesting and to the working of Jute; and generally any other information which you consider interesting and conducive to our purpose.]

Referring to the enclosures in your letter of the 19th instant, and which I now return, *viz.*, letters from Messrs.

Behre and Co., of Saigon, and Messrs. Peel Jacob and Co., of this city, on the subject of "the article Jute," I beg to say that although the correspondents at Saigon are seeking most important and voluminous information, I will endeavour to answer their numerous questions as fully as possible, on the main points at all events, as far as I am able from data collected over a very lengthy period, from my own personal experiments, from close observation of, and intimate relations with, the article as a commercial product in my dealings with it over nearly a quarter of a century; and as this may be of some use to the Society in case of future references like the one in question, I beg to place this at your disposal.

The plant they refer to, "Jutê" is the *Corchorus olitorius*, the Pât of the Bengalli, and its cultivation and preparation is as follows:—

The seed is sown as soon after the commencement of the early rains, as the ground can be prepared, say early in April. The plant is an annual, indigenous to Bengal, and is productive of fibre yarn for the manufacture of cloth, sacking and ropes, and though there are many varieties which are spread over various parts of the globe, yet only that species known as the common "Pat" of the natives, or Jute of commerce, is here generally cultivated for the market. It grows with an upright fibrous stem, varying in height from eight to eighteen feet, according to the culture, and bears small yellowish flowers, on the side of the stalks near the top. The soil used in most cases for the cultivation of Jute, and in which the plant grows most luxuriant, is a strong rich loam or alluvial soil, free from stagnant water, and the aspect open and clear of roots of trees. The land is well ploughed, after which it is harrowed previous to sowing, the seed is then lightly harrowed in; each grain produces but one stem. The seed is always sown broadcast, as the object is to produce a thick crop of plant, which standing closely together always draws up straight stalks free from laterals, better adapted to

the length and quality of Jute than if they were allowed to branch out which would be the case if sown thin.

The treatment of the crop is, in the first instance, confined to careful hand-weeding, which is generally performed at an early stage of its growth by women and children, who also thin out the too closely growing crop where necessary. The plants have quite sufficient room when three or four inches apart; no more labor is required until it is ready to cut. It is then cut down close to the roots, in some instances, uprooted, tied up in bundles and placed in shallow water, care being taken to cause them to sink and keep them submerged. After eight or ten days the bark separates, the bundles are taken up, and the fibres are exposed to the sun to be dried, and after being cleaned are considered fit for the market. Jute grown on uplands becomes superior in quality because water does not stagnate at the stalks of plants.

The crop will be ready for reaping from July to September, according to whether the cultivation is on high or low lands.

In this country, district of Bengal, a beegah of land is 20 cottahs of 720 square feet each, say 14,400 square feet, yielding on an average five to seven maunds of Jute fibre, that is about from 410 lbs. to 574 lbs. per beegah. I have known as much as ten maunds produced per beegah, but that is very excessive and under most favourable circumstances. The suctional powers of the plant are very great; the long pipe-like stem imbibes with rapid force the humidity of the soil, and is exhaustive to the productive capabilities of the land; hence chur-lands are so admirably adapted to this cultivation, as they are annually invigorated by the rich silts deposited during the rainy season, and the customary general overflow of all the rivers and bheels. Where lands are not within range of such influences, artificial manures have to be applied, rotation crops are arranged for, and the land is allowed to be fallow for two or three years to enable it to regain its recuperative powers. It is almost impossible to arrive at a correct

cost of production, for in very many instances the labor is entirely performed by the male, and partly by the female members of each homestead, from the preparation of the land, the sowing, harrowing, weeding, cutting, steeping, and preparing the fibre, &c. ; but approximately the cost may be stated to be in average about Rs. 11 to 12 per beegah, about seven to eight men being required. Rent of land varies according to district, locality, likewise suitableness of soil for other crops, such as food grains, cereals, oil seeds, &c. The seed may be valued at present at Rs. 2-8 to 3 a bazar maund, and about ten seers, or a fourth of a maund is required for a beegah. The land requires about three ploughings say by two bullocks and one man. Then there is the sowing, harrowing, weeding whilst the plant is young and until it is established, rearing its head in its rapid growth above the weeds, which are soon partially, if not wholly destroyed, as the plant asserts itself to the proprietorship of the soil.

Then follows the cutting of the plant, the steeping, or retting, as the process is known, separating the fibre from the stick, cleaning, drying, bundling, &c., and preparing it for the market.

With reference to the Saigon climate being suitable for the culture of Jute, where equal heat, or nearly so, is said to prevail throughout the year, say from 70° at night to 95° at noon, with rains from May to November, I am of opinion that it might do for the cultivation of the plant which thrives so well under the influence of alternate sun and rain.

As regards cultivators being procurable here to proceed to that country, I consider it most unlikely, highly improbable, and so very doubtful indeed that I think I may say at once they could not be induced to leave their families and homesteads for a foreign country.

The requirements, mechanical and others, and the best and most modern methods that have been introduced for the manufacture of the fibre into yarn and cloth, can be readily

obtained from any of the leading Dundee merchants and Engineers, who can supply plans and estimates of cost of engines, boilers, teasers, carding, drawing, roving, spinning, &c. frames, looms and all necessities pertaining thereto.

I think I have touched on all the needful points and made them as clear and explicit as my time will allow.

CALCUTTA,;
11th December, 1880. }

W. H. COGSWELL.

Remarks on the cultivation of the Carob (Ceratonia siliqua) at Hazaribagh by MR. J. WINTER. (Communicated by the Commissioner of Chota Nagpore).

HAVING for some time past taken considerable interest in the growth at Hazaribagh of the "Carob trees" and after putting the matter to a practical test, I take the liberty of submitting, most respectfully, for your information and should you deem it necessary for communication to the division authorities or the Agricultural and Horticultural Society of India, the following remarks with your own observations on the subject.

Primarily I would bring to notice that the note of instructions regarding the growth of the Carob trees issued by the Government of India and circulated with the Government of Bengal Circular No. 18, dated 4th July, 1876, is incorrect and misleading. Take for instance para. 8 page 85d. in the 3rd clause of which it is stated. "Dr. Jamieson accordingly. "brought with him a large quantity of seed from which he "raised a large number of plants, to test the value of the tree "in the dry places in the North Western Provinces. In the "following year (1863) he reported that the tree had been "extensively promulgated and distributed, but had not though "if flourished well yielded pods in each quantity as in Malta "or Sicily. This, however, he said might be due to the trees "being too young." This remark, I am unable to understand,

if Dr. Jamieson referred to the produce of the seed of the previous year, for the tree never fruits until it is seven years old at least. The emphatic observation however, *viz.*, that "the tree never fruits until it is seven years old at least," meets with a direct contradiction at para. 11, clause 2, page 85f., of the same "note" wherein it is said. "The tree was reintroduced into the Punjab, by Mr. George Ricketts, some of the seed imported by that gentleman in 1862, having been sown at Lahore and Ferozepore. In 1866 Dr. Henderson stated to the Agricultural and Horticultural Society of the Punjab that there were four large trees in Lahore, in the garden of gentlemen, one which was measured was three feet in girth at the ground, and they were all of the same size. One of them was in fruit when Dr. Henderson mentioned the subject. These were the produce of the seed brought out in 1862 by Mr. Ricketts. Trees produced from this seed were still growing at Lahore and Ferozepore in 1873, and in that year Mr. Ricketts sent the Agricultural and Horticultural Society of India some seed obtained from the trees at Ferozepore. Mr. Ricketts says it has been proved that the tree will thrive in the Punjab and North Western Provinces."

Thus we have three theories on the subject. Whilst the writer of the "Note" confidently asserts that "the tree never bears fruit until it is seven years old at least." Dr. Jamieson reports of it yielding pods in the year following its sowing, and Dr. Henderson is equally positive that one of four trees in Lahore was in fruit four years after the seed had been sown. Apart from this question of fruiting, I am in a position to correct Dr. Henderson on another point.

According to that gentleman a "four year old tree measured three feet in girth at the ground," now I have three healthy trees grown under my personal supervision, and they are each some two years and two months old, and none of them exceed 7 inches in girth at the ground.

To revert to my personal experience of Carob trees. On the 15th July, 1878, I received three plants.

They were from seeds sown in pots and were transplanted when about four inches high and I have noted their growth since which has been as follows:—

Date.	Tree No. 1.		Tree No. 2.		Tree No. 3.	
	F.	I.	F.	I.	F.	I.
1st July 1879 ..	1	1	1	3	1	1
1st October " ..		6	2	0	1	8
2nd January 1880 ..	4	0	2	9	2	6
4th March ,	5	4	3	6	3	6
9th September ,,	7	2	5	3	5	3

Nos. 2 and 3 have been allowed to grow without being pruned, whereas No. 1 has been pruned and trained to form a tree; its longest and lowest branches measure 2' 7" in length, while the bottom branches of the two allowed to grow as shrubs are 4' 3" long. The plant therefore appears to be inclined to form a bush more than a tree if let alone, notwithstanding that the plant pruned exceeds by far the other two in height.

On the 28th October, 1879, I received from the Agricultural and Horticultural Society, Lahore, 623 seeds, and almost all these have germinated, and are now from twelve to eighteen inches high.

The practical knowledge thus required enables me to offer the following observations:—

First.—The seed before sowing must be well soaked in water; some seeds will imbibe moisture and swell enough for sowing in a few days, while others have taken weeks, and a few over two months.

Second.—That to grow a Carob plantation the seed should be sown just where the trees are intended to be grown and the trees left undisturbed. I have found that plants thus grown, and the trees left undisturbed, are far stronger and healthier than those transplanted, either from pots or the open ground ; besides, there is much difficulty in transplanting as the roots take a downward course, and plants fourteen or sixteen inches high, will have roots thirty inches long.

Third.—That manuring and watering are not absolutely necessary. I have plants that have been manured and plants that have been watered three times a week before sunrise during the summer months, and neither of them shew any improvement over plants that were left without water or manure. The plants once germinated requires nothing more than keeping free from weeds and jungle.

Fourth.—That neither sun nor frost in any way interferes with the growth of the young seedlings.

Sixth.—The plants grows quicker in the dry season than during the rains.

Seventh.—Protection from cattle, &c., is all that is required and good dry soil.

It only remains for me to add that with a soil as dry as any in the North Western Provinces or the Punjab, the Hazaribagh district seems peculiarly well adapted for a Carob plantation, and there are ready at hand several plots of land suitable for the purpose well-fenced in by Aloe. In the face, however, of the contradictory nature of the instructions on the subject, published under authority, especially with a seven year's growth held forth as necessary to fructify, few indeed would be found willing to embark in the speculation on any large scale, excepting the Government, or tea planters might try it in some enclosed portion of their plantation.

HAZARIBAGH ;
 September, 1880. }

Memo. by the Superintendent of Jails, Hazaribagh.

I can quite corroborate Mr. Winter's statements as to the healthiness of the plants, and I think that he has conclusively shown that the climate of Hazaribagh is well suited to the growth of the Carob tree.

Memo. by the Deputy Commissioner, Hazaribagh.

Submitted in original to the Commissioner of Chota Nagpore. It seems doubtful whether the cultivation of the Carob will ever rank as an important industry in Bengal; and an experiment of this kind carried out within the walls of a large Jail is scarcely likely to introduce the plant to the notice of the general body of cultivators. Mr. Winter deserves great credit for the patience and care with which he has worked out the best mode of treating the seeds and the shrubs. I would suggest that his memorandum should be submitted to the Government of Bengal for communication to the Home, Revenue and Agricultural Department of the Government of India.

20th October, 1880.

Notes on the introduction of certain food grains and economic plants in the Himalayas. BY CAPT. J. F. POGSON, *Honorary Member.*

QUINOA.—“A variety of grain scarcely known in this country, (*United Kingdom*,) is the Quinoa; a small roundish seed which is extensively cultivated and consumed on the high table lands of Chili and Peru. There are two varieties of it, the sweet, and the bitter, which grow at elevations rising to 13,000 feet above the level of the sea, where both rye and barley refuse to ripen. It is still the principal food of the many thousands of people who occupy these high lands, and before the introduction of European grains by the Spaniards is said to have formed the chief nourishment of

the Peruvian nation. It is very nutritious, and in its composition approaches very nearly to that of oatmeal, but contains rather less fat. A grain so nutritious as this is a very precious gift to the inhabitants of the elevated regions of the Andes. Without it, those lofty plains could only be runs for cattle, like the summer pastures among the valleys on the Alps."

The above is taken from the latest edition of "Johnston's Chemistry of Common Life" edited by Mr. A. H. Church, and published in 1879. W. Blackwood & Sons.

The Editor makes a serious mistake in asserting that in former times the Quinoa formed the chief food of the Peruvian nation, and quite forgets that the magnificent maize and Indian corn of Chili and Peru, was the national food of the Peruvians, whose Highlanders or Hill men lived on the Quinoa, just as our Paharies, consume "Bathu," or "Amaranth," seed ground into meal when their wheat is out, and maize being harvested.

I submit that more information than that now possessed by us is needed on the subject of this valuable food grain, which if properly introduced into the Himalayas, North of Simla, would confer a great boon, and benefit on the fixed and travelling population. [See the interesting extract from Markham's recently published work on Peruvian Bark, under the head of Selections in this number of the Journal.]

Simla, is only 50 miles distant from Kotegurh, and the Hill sides en route terraced up to a certain altitude are carefully cultivated with maize, millets, bearded rice, (*Cheena*, *Bathu*,) wheat and barley. All lands above barley growing limit are uncultivated, and as their extent is very great, the introduction of rye, and both kinds of Quinoa, would result in the production of an abundant supply of food, and admit of land at lower elevations being put under superior grain crops. The ordinary price of wheat at Kotegurh

is five Rupees per maund of 40 pucca seers, and table rice is Rs. eight per maund. Grain, of other descriptions, is in proportion. Now, when we see that every patch of land, capable of being cultivated is sown, the prices demanded, and realized are excessive. The reason why, is that the consumption is greater than the production.

To meet this evil, which is not only confined to this locality, I would venture to suggest, my being supplied as soon as possible, with one pound of the sweet, and half a pound of bitter Quinoa seed, to be obtained through the Society's correspondents, direct from the high table lands of the Andes. [An application has been made to Mr. Markham for his valuable aid towards meeting Capt. Pogson's request.]

I will take care that the experiment does not result in failure, and the seed harvested in the autumn of 1881, will be available for distribution to the Hill Zemindars in 1882.

As regards rye, I will import a supply of seed from Sutton & Sons in due course, sow, grow, and harvest it, and report the results.

I must now trespass on your time with another proposition, connected with the medical plant garden I have in hand. I would wish to be supplied with one ounce of genuine biennial "*Hyoseyamus niger*" seed, to be obtained from Mitcham, Hitchin, or Market Deeping in which places this true and medicinal variety is regularly cultivated.

The *annual* variety is of no medicinal value, and as it is cultivated at Saharunpore Botanical Gardens for supplying the Medical Department with "extract of Henbane," (of no value) I obtained some of the seed, raised a good crop, and then discovered that I had grown the *annual*, or worthless variety instead of the biennial or medical, (*official*) plant.

I should also like to obtain some seeds, ($\frac{1}{4}$ ounce) of the "Squirting Cucumber," or "*Elaterium*." Also it is cultivated at Mitcham and the other places named. These have

been indented for through Messrs. Sutton & Sons of Reading, the Society's seedsmen.

The next plant on my list is of considerable commercial and medicinal value, and its introduction and trial in several Himalayan localities is a decided desideratum. It is the *Sanguinaria Canadensis*, (Linn.) Blood-root, Puccoon, Red-root, North America.

"Juice blood-red, used in dyeing; fruit narcotic; root *Sanguinaria*, P. U. S., emetic, purgative, (G.) An acrid narcotic; in small doses it lowers the pulse, in smaller still it has some reputation as a tonic stimulant; powder of root acts violently as an emetic, is a useful escharotic in cases of soft polypi, has been recommended in typhoid pneumonia, phthisis, croup, hydrothorax, and jaundice, (L.) See supplements London Pharmacopœia, 3rd Edition, 1857.

The value of this Canadian plant, and its products is apparent, and as the three high mountains in my immediate vicinity, i. e., Mounts "*Huttoo*," *Narkunla*, and *Chee-chur*, have the necessary climate and soil, success may be reasonably expected.

A good red dye well sell in all markets, including those of Hindoostan, and a drug which will act as a purgative and emetic, will supply a great want for the natives of India being given to over-eating when possible, suffer from repletion, and bile. Ipecacuanha and jalap, are costly and in the "*Mofussil*" often unattainable remedies. But the "*Puccoon*" root, would soon find its way into every "*Punsaree's*" shop, and much good would result. The fruit if operated on, as the poppy head is for its opium, might yield a valuable narcotic, and I dare say the leaves would prove of medicinal value.

If it could be obtained from North America, United States, I should like to secure some seed of the "*Podophyllum Pellatum*," (Linn.) may-apples, or maudrake. [Applica-

tion for these has been made to the Society's American seedsman.]

Information to be supplied as to the climate needed for its culture. At present this valuable cathartic, is a source of very considerable income to Indian Chemists only, and might with great advantage take the place of Croton nut, and its oil, and come into general use amongst the natives.

I hope Mr. Markham's support will tend to bring the Quinoa, and superior Cuzco Maize into use in these Hills. The seeds of Cuzco sent me from Saharunpore were far inferior in size to those sent me by you at Simla, and duly reported on. Mr. G.——s' Maize raised at Nepal, or Katmandoo, seems a new variety for in appearance it is quite different from other kinds of Cuzco, and the small or "Cracker corn," vel. "Pop corn," I have already grown here, from seed given me last year before his death by Rev. J. Newton.

I wish I had some of the large seeded Cuzco Maize, like that originally sent by Mr. Markham, I am pretty certain it would answer here, or say 1,000 feet lower down. The Zemindars will now grow any seed I give them, in this line, and that is a great point gained.

Seeds of medicinal plants. I should like the following to be added on to my list, viz.

1. The Liquorice of England and Europe or "*Glycyrrhiza glabra*."

It is much cultivated at Mitcham.

2. Deadly night shade, "*Atropa Belladonna*."

3. True Colocynth of Egypt and Turkey. "*Cucumis Colocynthis*."

The "Indrajin" or Hill colocynth, grows in our Khuds, but as it is a substitute, I should like to have the real thing.

Correspondence and Selections.

CHINCHONA CULTIVATION IN INDIA.

[THE following history of Chinchona cultivation in India may be most appropriately reprinted in this Journal, it being a subject on which the Agri-Horticultural Society of India has taken much interest for the last quarter of a century. The proposal for deputing a qualified person from England to South America, to procure seeds and young plants of the best species of the Quinine-yielding Chinchonas, emanated from the Society in the year 1852, and was warmly recommended to the Court of Directors by the then Governor-General, the Marquis of Dalhousie. An able paper on the subject was at the same time prepared by the late Dr. Hugh Falconer, then Superintendent of the Royal Botanic Garden, Calcutta, a Vice-President, and a most active and zealous Member of the Society. This paper is printed in Vol. 8 of the Journal.]

The introduction of Chinchona cultivation into India was undertaken with the object of insuring a cheap and unfailing supply of the febrifuge for the use of the millions who annually suffer from fever.

Fever is by far the most prolific cause of death in India, carrying off very many more than all other diseases and accidents put together. The total number of deaths from fever in India is upwards of a million and a half annually. At least half these deaths will eventually be prevented by putting some cheap form of the Chinchona alkaloids into every Druggist's shop in the country at one rupee per ounce; and thus multitudes will be saved from death or grievous suffering.

The successful introduction of Chinchona cultivation into India has been a task of considerable difficulty in all its stages. It was not only necessary to transplant a genus of plants from one side of the world to the other, it was also an essential element of success to convert wild into cultivated plants. This involved a close study of the climate, soil, and general physical aspects of each region where the valuable species grow in their native forests; a comparison of these circumstances with those

prevailing in the East Indies, the discovery of the best species, and also of the species best adapted to secure good results in their new homes, the study of all the requirements of the plants under cultivation, without any guide, as the Chinchona had never before been cultivated; and finally, the solution of numerous very complicated questions relating to the best and cheapest form in which the febrifuge can be provided for general use.

The task was difficult and complicated. Mr. Markham undertook it in 1859, and all arrangements connected with the collection of plants and seeds in South America, and their conveyance to India, have been made by him, and carried out under his superintendence. His original plan was to depute collectors to the different regions of the Andes where the various species flourish, to have the collections made simultaneously, and to convey them direct across the Pacific to India, in a special steamer. But only a portion of his scheme obtained sanction, and no steamer was provided. He was, however, determined that all the species should be secured eventually, and that the work should be complete, even if it extended over many years. This has been the case. It has taken many years to do what might have been done in one or two, and the expense has been quadrupled. Yet the whole work is now at last complete.

In 1859 Mr. Markham was only able to organise three expeditions; one, under his own command, to obtain plants and seeds of the *Calisayas* and other species from Carabaya, in Southern Peru, yielding the yellow barks of commerce; a second, under Mr. Prichett, to collect species in the forests of Central Peru yielding the grey barks of commerce; and a third, under that eminent botanist, Richard Spruce, to collect plants and seeds of the *Chinchona succirubra* in the forests of Ecuador, yielding the red bark.

In 1860 the whole of this work was done, and done thoroughly, so far as the difficult and dangerous part of it in the Andean forests, and the conveyance of the plants to sea ports on the coasts of the Pacific, were concerned; but the failure to furnish the means of direct conveyance to India led to disasters which were inevitable. The plants had to be conveyed across the Isthmus of Panama, then to England, then across Egypt, and down the Red Sea to India. The first instalment from Southern Peru all died on the passage, or after reaching India; but the seeds forwarded in the following year germinated, and thus a stock of *C. Calisaya* trees was secured. Subsequently more seeds from Bolivia, collected by Mr. Ledger, were received, and the plants raised from them have proved to be an exceedingly valuable variety, which has received the name of *Ledgeriana*. The second instalment of plants, consisting of those yielding grey bark, was equally unfortunate, but the

precaution had also been taken of obtaining seeds from which a stock of plants yielding grey barks was established in India. The third instalment, coming at a cooler season for passing down the Red Sea, was more fortunate. It consisted of plants of *C. succirubra*, yielding red bark, nearly all of which arrived safely. Thus by 1862 the arrangements made by Mr. Markham as regards the above species were crowned with complete success; but the work of introducing all the best species was still far from finished. It remained to obtain the valuable species from Ecuador, yielding the crown barks, and also the renowned species of Colombia.

Accordingly Mr. Markham obtained sanction for the dispatch of a collector to Cuenca and Loxa in southern Ecuador to obtain seeds of the *C. officinalis*, the original species of Linnæus (afterwards called *C. nudaminea*) from the bark of which the Countess of Chinchón was cured. For this service he selected Mr. Robert Cross, an experienced gardener, who had already acquired experience under Mr. Spruce, with instructions to obtain a supply of seeds of the best Loxa species yielding crown bark. Mr. Cross reached Ecuador in 1862, made a good collection in spite of extraordinary difficulties, and the seeds arrived safely in India and Ceylon, and germinated freely. Mr. Howard, the well-known quinine manufacturer, also presented a fine plant of *C. officinalis*, (Von Uritusinga) from which a large stock has been obtained. Thus the introduction of the crown bark species was secured.

Mr. Markham's next care was to obtain and introduce plants of a valuable species called *C. pitayensis*, which grows on the slopes of the central cordillera of Colombia, near Popayan. For this work he again secured the services of Mr. Cross, who set out in 1863 and made a good collection of seeds, but, owing to damage suffered in their transit, they did not germinate. After some delay Mr. Markham obtained sanction for a second attempt, and in 1868 Mr. Cross again set out for Colombia, this time with more fortunate results, for the seeds of *C. pitayensis* collected by him near Popayan arrived safely, and germinated freely in India.

Meanwhile the destruction of *C. pitayensis* in its native forests led the collectors to seek for other trees in more distant regions, and a new bark began to appear in the market, of great value, known as the *Oalisayade Santa Fé*. Mr. Markham resolved that this species should also be introduced into India. The service was one of special difficulty and danger, for the trees are only found on the eastern cordillera of Colombia, near the sources of the Cagnetá. He again intrusted the work to Mr. Cross in 1877, and again his confidence in that intrepid and most able explorer was justified. In March 1878 Mr. Cross arrived at Kew with a good supply of plants of the *Oalisaya de Santa Fé*, and also of the *C. cordifolia*, yielding the Carthagena barks of commerce.

Thus at length all the valuable species of febrifuge Chinchona plants, indigenous to South America, have been successfully introduced into India. They are as follows :—

- C. Calisaya* (yellow barks) Bolivia and Caravaya.
- C. nitida* } (grey barks) Central Peru.
- C. micrantha* }
- C. Peruviana* }
- C. succirubra* (red barks) Ecuador.
- C. officinalis* (crown barks) Ecuador.
- C. Pitayensis* } (Pitayo bark) }
- C. Palisaga de Santa Fe.* } (Carthagena barks) } Colombia.
- C. cordifolia* }

The first and most hazardous stage of the enterprise was the collection of the plants and seeds in south America and their conveyance to India. The second and equally difficult stage was the cultivation and the discovery of the species best suited for India, as well as the best method of treatment with a view to producing the largest percentage of febrifuge alkaloids in the barks.

The first step was the selection of the most suitable sites for the plantations, being those having most resemblance to the native habitat of the Chinchona. Mr. Markman proceeded to India in 1860 to perform this duty; and chose a site at Neddivattam, on the northern slopes of the Neilgherry Hills, facing Wynaad, for the plants of *C. succirubra*, the *C. Calisaya* and grey barks; and a site at a greater elevation, under the Dodabetta peak, for the *C. officinalis* plants. He also selected sites for plantations in Coorg and the Pulney Hills, and, on the occasion of a second visit to India in 1866, in Travancore and Wynaad.

The successful conversion of the Chinchona from a wild to a cultivated tree is due to the unrivalled skill and ability of the late Mr. McIvor, Superintendent of Chinchona cultivation, in the Madras Presidency. Mr. McIvor propagated the plants with great success, established them in the plantations, discovered the conditions under which they would give the largest yield, and also the method of renewing the bark by the mossing process, which undoubtedly secures an increased percentage of febrifuge alkaloids. The final conclusions are that the *C. succirubra* species is best adapted for use in India, and for furnishing abundant supplies of a cheap febrifuge; while the *C. officinalis* and the Columbian kinds will be the most valuable barks for the London market, and for securing a remunerative return on the outlay. By 1870 the Neilgherry Chinchona plantations, belonging to the Government, covered 1,200 acres of ground; while private individuals possessed several thriving and paying plantations on the Neilgherries and in Wynaad, 2,35,747 plants having been distributed up to 1875.

In the same year there were over a million Chinchona trees in the Government plantations.

In 1862 a Chinchona plantation was established in British Sikkim, under the superintendence of Dr. Anderson, plants of *C. succirubra* having been obtained from the Neilgherry hills. Other kinds are not likely to flourish in the Sikkim climate, but the *C. succirubra* is well established in the Rungbee plantation. By the year 1875 there were upwards of two million plants of *C. succirubra* at Runbee, and the propagation can be carried on with ease to any extent.

Thus the second stage of the enterprise, namely the cultivation, was crowned with complete success.

The third and most important measure is the supply of a cheap febrifuge to the people. As soon as it was established that the *C. succirubra* would be the best species for India, a very critical point arose. That species yields a very large percentage of total febrifuge alkaloids, but only a small quantity of quinine. Mr. Markham saw that it was of vital consequence to discover the medicinal value of the other alkaloids, namely chinchonidine, quinidine, and chinchonine; and to ascertain whether they equally with quinine, possessed the precious febrifuge qualities. He accordingly obtained the appointment of Medical Commissions in 1866, for each of the three Presidencies, to investigate and report upon this question. The result was that chinchonidine (the principal alkaloid in *C. succirubra*) and quinidine were found to be quite equal to quinine, and chinchonine inferior, though still efficacious in larger doses. This was a great point, for it made a cheap febrifuge medicine possible. The extraction of pure quinine is an expensive process, but the production of a medicine containing the total alkaloids in the bark is easy and simple.

This important fact having been established, Mr. Markham next urged the adoption of a measure calculated to secure the final object of the introduction of Chinchona cultivation into India; namely, the preparation of a febrifuge medicine at the Government plantations, which should contain all the alkaloids, and should be saleable at a cheap rate. With this object Mr. Broughton was appointed as quinologist on the Neilgherry Hills in 1866; and in 1873 Mr. Wood received a similar appointment for the Sikkim plantations. Mr. Broughton adopted a method for the manufacture of his medicine which entailed the use of alcohol, and was, therefore, too expensive. Up to 1873 he had made about 600 lbs. of an amorphous Chinchona alkaloid, but the essential requisite of cheapness was not secured. His method was consequently abandoned. Mr. Wood began his actual manufacturing operations in 1875. His method is the same as that recommended by the learned quinologist of the Hague, Dr. J. E. DeVrij, who calls the resulting product *quinetum*.

The powdered bark is first exhausted with cold acidulated water and the resulting liquor is precipitated by a caustic alkali. Scarcely any fuel is required, and no expensive machinery, merely some wooden tubs and calico filters. There can soon be yielded, by this process, about 1,40,000 ounces of an efficient Chinchona alkaloid every year, at a cost of less than 1 Rupee per ounce. Quinine, in England, is from eight to nine shillings an ounce, and in India the price is much higher.

Thus the great object of this difficult undertaking is on the eve of being secured; and an inestimable blessing will be conferred upon India; while at the same time the barks rich in quinine will be sold in the London market, and will repay all the outlay with interest. The sum of 40,000*l.* was realized by these sales in 1877 alone. While, on the one hand, Chinchona cultivation will be a most remunerative public work, on the other it will rob the malarious fevers of India of three-fourths of their victims, and will, to that extent, diminish the amount of human misery and suffering.

G. B.

(Handbook to the British Indian Section of the Paris Universal Exhibition of 1878.)

Monograph on the Wild Silk Industry of India, illustrated by the contents of the Large Glass Case, containing Wild Silk specimens in the India Section.—Dedicated with great respect to P. CUNLIFFE OWEN, ESQ., C. B.

[THE wild Silk Industry of India has engaged the attention of the Agri-Horticultural Society, at various times, for the past forty years, as a reference to its Transactions and Journal will shew. It was so long ago as the year 1839 that the Society offered a reward of Rs. 500 for promoting the cultivation of the Eria Silk-worm of Assam and the reeling of its silk. Nearly every volume from that period till recently contains notices on the wild silk-worms of India, including several able papers by the late Capt. Thos. Hutton of Mussooree. It is satisfactory to learn from the following Monograph that Mr. Wardle has been so successful in developing an industry which may ere long become so important.]

It is the Silk produced by the Tasar or Tussore worm, in which the chief interest of the case lies.

I have endeavoured to exhibit this Silk in as full a manner as the space assigned to me would permit, representing it in all states of its manufacture and tinctorial enrichment, showing the recent improvement in manufacture and dyeing of which it is capable, as well as illustrating the Natural History of the Tussore insect in all stages of its developement, by preserved specimens

of its several phases, except the larvæ, which it has not been possible to obtain.

Tussore Silk has long been known and used by the natives of India. They have exported it in considerable quantities of late years, but from their imperfect mode of manipulating it in its earlier stages of manufacture, and from the difficulty of dyeing it well, it has made but little way in Europe except for ladies' and children's dresses in an undyed state.

In Bengal and the adjoining provinces from time immemorial the natives have manufactured this silk into cloth called "Tusseh Doothies," which is worn by Brahmins and other sects of Hindoos.

The Silk is found from the North-west range of the Himalaya south as far as Midnapore, in Bengal, and through the North-east range to Assam, and southward to Chittagong and probably further. It is found also in the Presidencies of Bombay and Madras. It is said to be abundant in Bhagulpore in Bengal. It abounds chiefly in the Eastern districts of Chhattisgarh, namely Raipur, Bilaspur, and Sambulpur, in the Chanda district of the Nagpore province, and the Seone district.

The natural colour of the silk is a darkish shade of fawn, much unlike the golden and white colours of the Mulberry-worm silk.

It has much less affinity for dye-stuffs, especially for those which grow in India, and it has not until recently been much dyed.

For several years I have been engaged with considerable success in improving the methods of dyeing, and the results are shown in the case, Nos. 10, 11, 12, 20, 40, 41, 42, 52.

Important improvements which I have had effected in the manufacture of Tussore silk are shown in Nos. 8, 9, 18, 19, 21, 51, 53, 54, 55, which will be fully described in their turn.

These improvements in the manufacture and dyeing are most likely to have a very great influence on the cultivation of this silk, and probably also of other wild silks, the demand for which may in a few years be only measured by the quantity which can be produced.

The first specimen under No. 1 in the case is a leaf of a species of *Terminalia* containing eggs of the Tussore moth, which are said to hatch in from two to four weeks.

The larvae, when fully grown, are about four inches in length; they have twelve joints or articulations, besides their extremities; their colour is green resembling the leaves on which they feed; and they are marked with reddish spots and a reddish yellow band running lengthways. They feed on several plants:—

Rhizophora calceolaris. Linn

Terminalia alata glabra (Assam tree).

Terminalia Catappa (Country almond tree).

Tectona grandis.

Zizyphus jujuba.
Shorea robusta.
Bombax heptaphyllum.
Careya sphærica.
Pentaptera tomentosa.
Pentaptera glabra.
Ricinus communis (Castor oil plant).
Cassia lanceolata.

In six weeks from the time they are hatched they begin to spin their cocoons, which they most curiously suspend from the branches of the trees by constructing a thick hard cord or filament of silky matter, which is made to grasp the branches, as seen in the specimens No. 3.

As soon as the worm has spun its cocoon it takes the form of chrysalis or pupa (see No. 2), and remains a prisoner in the cocoons for about nine months, or from October until July. At the end of this time the chrysalis takes the form of a moth, and whilst its wings are in an imperfectly developed state it softens one end of the cocoons with an exudation which enables it to separate the filaments of silk and to work its way out of the cocoon. This it effects during the night.

Those shown under No. 4 are cocoons from which the moth has emerged.

No. 5

Are Tussore cocoon, from Sambulpore, in the Central Provinces, but larger than those under No. 3.

The weight of the ordinary Tussore cocoons with its pupa enclosed and the cord by which it is attached to the branch is about five grammes.

Nos. 6 AND 7

Are specimens of Tussore moths known under the following names:—

Antherea Paphia (Linnaeus).
Bombyx „ (Hübner).
Saturnia „ (Helfer).
Phalaena Attacus Mylitta (Dumy).
 „ *Paphia* (Roxburgh).
Bombyx Mylitta (Fabricius).
 “Bugly” of the Native of Beerbhoom Hills
 where the silk which the same people call
 “Tusseh” is manufactured.

The male is of a reddish pale brown colour, and the female much yellower.

Mr. O'Neil in his report says :—" The moths are particularly " revered by the people engaged in the culture of the worms, " the occulili on their wing being considered at the 'chakra' or " mark of Vishnu. These people also pretend to observe the " greatest purity of life during the time they are in the jungles " rearing the worms, and also do not eat flesh, fish or spices, " do not shave or cut their hair, do not wear washed clothing, nor " anoint their bodies with oil, and do not touch any of whom a " relative may have recently died."

NOS. 8 AND 9.

Organzine and Tram Tussore of the quality and state of manufacture now used in England for weaving, and a good representation of the present state of its manufacture which gives a size of 255 deniers (15 drams per 1,000 yards). The sizes of the Tussore silk generally used in England run from 152 denier, (9 drams) to 255 deniers (15 drams). This is a coarse size and must of necessity be unfit to produce such fine textile work as the mulberry silk which is manufactured into Organzine and Tram of 21 deniers and upwards ($1\frac{1}{4}$ drams) and from which are made the finest silk fabrics.

The printed cloths, Nos. 21 and 55, are made with Tussore Organzine and Tram of the coarse size of Nos. 8 and 9 and of the same quality.

The want of fineness and quality is owing to the imperfect and unskilful mode of manipulating it from the cocoon upwards in India, and the want of better machinery to prepare it in the grège state.

NOS. 10, 11, AND 12.

The same silks dyed in colours and black. Nos. 10 and 12 are dyed entirely with Indian dyestuffs, and are well worthy of notice.

No. 13.

Native reeled Tussore raw silk, undyed. From Bhagulpore.

No. 14.

Another specimen of native reeled Tussore raw silk undyed.

No. 15.

The same silk dyed by the natives.

No. 16.

Native reeled Tussore raw silk, undyed. From Bogra.

No. 17.

Native reeled Tussore, from Bengal, undyed.

No. 17a.

Tussore raw silk manufactured from the same species of cocoons as those under No. 3, illustrative of the great improvement, of which it is now susceptible.

No. 18.

Organzine Tussore, the same as No. 12 reeled in India, and manufactured in England, 255 deniers 15 drams per 1,000 yards. Placed here to contrast with the next specimens of improved manufacture.

No. 19.

Organzine Tussore, manufactured, etc., under my own instructions and superintendence.

The improvement in quality, fineness, and cleanness, will be seen to be most marked, and that instead of the coarse sizes of Tussore now used, of 152 to 255 deniers (9 to 15 drams), there may be obtained by proper management Organzine and Tram of excellent quality from the same cocoons of 51 deniers (3 drams) and upwards which can be woven into a great variety of stuffs for which until now only the mulberry silks have been available.

The attention of all interested in, or connected with silk manufacture, cannot be too strongly drawn to this fact, nor can its value be overrated.

There is a most important future in store for the Tussore silk industry, and as great improvements will take place as those which resulted from the introduction of proper machinery and skill many years ago, in the mulberry silk districts of Bengal, when it was found that Bengal silks, in place of being then almost unworkable, could be manufactured in such a way as to bring them into extended use in Europe, so as even to rival French and Italian silks. The cost of making Organzine and Tram from the cocoons with the improved mode is about 15 francs per kilogramme. Mr. Neil, in his report (1875), says: "The contrivances for manufacturing silk are very simple, but improvement is required in the art of manufacturing silk fabrics.

No. 20.

This is the same silk as No. 19, dyed by improved processes with Aniline dyes, to show the delicacy of hue this silk is capable of affording under the altered treatment. There is scarcely any shade of colour, dark or light, which cannot now be dyed on Tussore silk.

No. 21.

In the upper part of the case I have printed upon Tussore silk fabrics, made with Organzine and Tram, Nos. 8 and 9, a series

of patterns to show that it is now possible to print on this silk. It is, as far as I am aware, the first time any attempt has been made either in Europe or in the East to print on wild silk cloth of any kind.

So that now printed Tussor silk can be successfully used for wall damasks, curtains, furniture coverings, hangings, women's and girls' dresses with great effect, and I would draw the attention of upholsterers and broad silk manufacturers to these specimens, and specially to three under No. 55, of twill-silk, made of this material. Also from the warp and weft of Nos. 8 and 9, 255 deniers.

The silk fabrics made of Tussore are very strong, most durable, and possess much lustre.

The patterns printed in blue are the first successful application of indigo on silk as a print, and not as a pencil blue.

They will be proved remarkably fast, in fact none of the colours are printed in Aniline or any other fugative dyes.

Notice the rich tone of blue they bear, modified to some extent by the ground colour which has controlled too great a brightness.

I shall have more to say on the artistic nature of the vegetable colour products of India in my description of the collection of the dyestuffs of India exhibited in this section.

No. 24.

Three moths and six cocoons of *Attacus Cynthia*, a wild silk-worm of India, producing the silk known as Eri or Eria of Assam.

It is also known under the following names:—

Phalæna Cynthia (Roxburgh).

Bombyx Cynthia (Olivier).

Sania Cynthia (Hubner).

Saturnia Cynthia (Westwood).

Saturnia Arrundi (Royle).

The Arrundi or Arrundi silk-worm moth (Roxburgh).

With this I must connect the *Attacus Ricini* (Boisduval,) the same insect as far as I can gather, except that it is fed on the *Ricinus communis* or Palma Christi plant, and is reared in a domesticated state in Assam, and over a great part of Hindustan, more especially in the districts of Dinagpur and Rangpur.

Mr. Hugon gives the following interesting particulars respecting it:—"The larva when at full size is about $3\frac{1}{2}$ inches long. It spins its cocoon in four days. The hill tribes settled in the plains are fond of eating the chrysalis."

The cocoon is much smaller than that of the Tusseh and is soft. The natives cannot wind the silk, but spin it like cotton. Dr. Helfer says the insect is so productive as to give sometimes

twelve broods a year, and that the worm grows rapidly and offers no difficulty whatever for an extensive speculation.

Mr. Atkinson says the filament is so delicate as to render it impracticable to wind off the silk, it is therefore spun like cotton. The yarn thus manufactured is woven into a coarse kind of white cloth, of a seemingly loose texture, but of incredible durability, the life of one person being seldom sufficient to wear out a garment made of it.

The winding of the Eria cocoon is said to have been recently accomplished, the thickness of the Eria filament is $\frac{1}{3600}$ of an inch.

Leaving the question as to whether it can be successfully wound or not, one important consideration respecting its use presents itself, namely, its capability of being spun like cotton and wool. The great improvements made in late years in England in spinning machinery have proved that marvellous results in making an even thread from waste silk and unwindable cocoons for sewing and weaving purposes may be attained, and I will venture to predict a future for this and the produce of the unwindable silk worm cocoons that will compensate for their collection.

The industry of the natives should be stimulated to the gathering in of all kinds of wild silk cocoons, whether windable or not, for there is no doubt that those kinds which cannot be wound can be most easily spun, and there is at the present moment a request on the part of silk spinners for a larger supply of Tussore silk, cocoon and Tussore silk waste, for spinning purposes, and no doubt other silk cocoons would be gladly bought up.

No. 25.

A sample of Eria silk spun, no doubt by hand, by the Natives.

No. 26.

The same imperfectly dyed by them.

No. 27.

Eria silk made by the Ricini-fed worm of Assam.

No. 28.

The same from another district of Assam (Lakhimpur).

Nos. 29 & 30

Are specimens, male and female, of the moth:—

Attacus Atlas (Hübner).

Phalæna Attacus Atlas (Linnæus.)

Bombyx Atlas (Fabricius).

This moth feeds on the *Phyllanthus emblica*.

No. 30

Is a specimen of the cocoon of this splendid moth which might easily be spun.

No. 31.

Actias Selene;
Phalæna Attacus;

Feeds on Munsooree (*Coriaria nipalensis*). The cocoon is enclosed between two leaves. The silk does not appear to be windable, but is of a coarsish kind and might also be spun.

No. 32.

Cocoons of *Actias Selene*.

Nos. 33 AND 34.

Moths, male and female, and cocoons of *Bombyx Attacus* (*Yama Mai*).

Although this insect is a native of Japan, it is found also in China and India.

In Japan the silk of this worm is said to be most highly prized and reserved for the use of Royalty, but this I am inclined to doubt, as the silk is very fine, the cocoon is of a beautiful pale green colour.

It has been naturalized in Europe.

A cross between the *Yama Mai* and *Bombyx Attacus Pernyi* is a great success in France. It is so hardy that breeding is said to take place at freezing point.

Nos. 35 AND 36.

Cocoons and silk of the Mooga or Moonga worm, *Antherea Assama*.

There are five breeds of this worm per year. They feed on the Addakoory, Champa, Soona, Koontoolou, Digluttee, Pattee, Shoonda, and Souhalloo.

No. 37.

A silk called Ya-bame from the district of Prome, Burmah, the produce of the *Bombyx Mori*.

No. 38.

Eggs, cocoons, moths, and silk grège of the *Bombyx Mori*. This is the Bengal silk of commerce. The worms feed on the leaves of the Mulberry tree as in China, Japan, and Europe.

No. 39.

"Pat" silk. A rare kind of silk from Assam, probably a variety of *Bombyx Mori*, but stated to be the produce of *Bombyn Tentæ*. The worm is fed on the Mulberry leaf.

No. 40.

A rare silk from Mezankuri-Assam.

No. 41.

Another specimen of "Pat" or "Pat Suta" silk with cocoons. A mulberry silk from Assam.

Nos. 42 AND 43.

A set of Tussore patterns dyed with Aniline colours.

These are placed here to show the shades Aniline dyes can be made to give on this silk, and not as a recommendation of their use in this direction. Native dyestuffs will give more permanent colours, properly mordanted. Aniline dyes are fugitive, and their use for artistic purposes or for goods intended to last a long time cannot be too seriously lamented.

No. 44.

This is a sample of ordinary Bengal Organzine, dyed with a dye-stuff common in most parts of British India, not used, as far as I know, in Europe.

It is the powder brushed off the capsules of the *Mallotus Phillipensis*, called in India "Kapila" or "Kamala" which contains 70 or 80 per cent. of colouring matter. By mordanting the silk with carbonate of soda and alum, the powder yields a rich variety of shades of golden yellow and orange colours. It appears to be worthy of the notice of European dyers.

Nos. 45 AND 51.

A series of patterns to show to what uses, the waste of Tussah Silk and the cocoons pierced by the exit of the moth can be put by spinning in the same way threads of cotton and wool are manufactured. It commences with samples of pierced cocoons which could not be wound, waste silk from ordinary Tussore manufactured and followed by samples showing the various processes the silk undergoes before it is made into thread or cord for weaving or for sewing purposes.

This suggests forcibly a promising economy in store for the produce of all silk-making worms. There are many species unknown to commerce, rejected because of their not being capable of being wound in the ordinary way, but, as I have before stated, now spinning machinery is in such a perfect state, all cocoons may be spun and converted into materials of some use or other. In Simla alone, there are said to be eight or nine species of *Bombyx*, which no doubt might be utilized in this way.

These remarks lead me to describe—

Nos. 53 AND 54,

which are patterns of spun Tussore made in the way and from the material I have just described, threads of various sizes for sewing and weaving purposes as well as for fringes and knitting, dyed and undyed. They may be dyed almost any shade.

No. 56

are fabrics made of this spun Tussore, woven undyed, in several designs for me by Messrs. Clayton, Marsden, Holden

& Co., silk spinners of Halifax, who also made me the samples 46 to 57 from pierced cocoons and waste Tussore with which I furnished them, from material collected from me in India by order of the Government of India.

No. 57.

A pattern of the same kind as No. 56, but which I have printed in seven colours.

Tussore silk is, therefore, proved to be capable of extended use, both from the improved manufacture I have spoken of and from the circumstances that it is capable of being dyed and printed in the greatest variety of colours, and that the refuse portions can be spun into threads for such a variety of purposes that there need be no waste ; and I am thankful to have had the honour of being entrusted to point out the extended usefulness and application of the Tussore, and all other species of wild silks.

I attach a tabular statement of microscopic measurements of the primary fibre of Tussore and other silks.

(Signed) THOS. WARDLE, .

Leek.

June 18th, 1878.

Silk and of other Si

Primary

Diameter

Micro Me

Names of Worms or Moths producing Silks.		Country.	Food of Larvæ.	Measurement of the Diameter of the Primary Fibre.			
Scientific Names.	Vernacular Names.			French Metric Scale.	English Scale.	Loose Silk on Outside of Cocoons.	Silk forming Sub-stance of Cocoons.
Bombyx mori ...	...	China ...	Mulberry	...	·0125 mm.	...	$\frac{1}{1000}$ in.
" (white) ...	...	Bengal ...	"	...	·006 "	...	$\frac{1}{1000}$ "
" (yellow) ...	...	"	"	...	·0083 "	...	$\frac{1}{1000}$ "
" ...	Ya-baine	Prone (Burmah)...	"	...	·01 "	...	$\frac{1}{1000}$ "
" ...	...	Italian ...	"	...	·0108 "	...	$\frac{1}{1000}$ "
" ...	...	French ...	"	...	·0135 "	...	$\frac{1}{1000}$ "
" textor...	" Pat"	Assam ...	"	...	·01 "	...	$\frac{1}{1000}$ "
Attacus ricini ...	Eria	India ...	"	...	·016 mm.	$\frac{1}{1000}$ in.	$\frac{1}{1000}$ "
Antherea Assama	Mugah or Moongah	...	Ricinus Communis, or Castor-oil plant.	...	·0135 "	$\frac{1}{1000}$ "	$\frac{1}{1000}$ "
Antherea Paphia (Tussore)	Aistari Poln koa ...	Beerbhoom (Bengal)	Addakoory and various other plants.	...	·01 "	$\frac{1}{1000}$ "	$\frac{1}{1000}$ "
	"Tassar," "Tusseh"	India ...	Terminalias and other plants.	None	·03125 "	None	$\frac{1}{1000}$ "
Actias selene ...	Mezankuri (rare)...	Sibsagar (Assam)...	...	...	·01 "	...	$\frac{1}{1000}$ "
Attacus Atlas ...	...	India ...	Coriaria nepalensis ...	...	·02 "	$\frac{1}{1000}$ in.	$\frac{1}{1000}$ "
Bombyx Attacus (the Oak)	...	India (?)	Phyllanthus emblica	...	·02 "	$\frac{1}{1000}$ "	$\frac{1}{1000}$ "
Silk-worm.	Yami mai	India ...	...	...	·025 "	$\frac{1}{1000}$ "	$\frac{1}{1000}$ "

Sketch of the Flora of Rajputana; By GEORGE KING, M.B., F.L.S.,
Superintendent, Botanical Garden, Calcutta.

As might be expected from its geographical position and limited rainfall, the flora of Rajputana is not a rich one. The number of indigenous species is but small, and few of these are attractive in appearance. The province is divided by the Arvali range of hills into two unequal parts—the part to the eastward of the range lying in the basin of the Chambal, and that to the westward in the basin of the Indus. This division is, to a great extent, coincident with certain features in the physical configuration, meteorology and vegetation of the province; and these two portions may, therefore, be conveniently treated of separately. The vegetation of the dividing range itself, and of the outlying mountain mass of Aboo, so much more resembles that of the eastern than that of the western tract, that it may be treated along with the former.

Eastern Rajputana.—The country to the east of the Arvali is (with the exception of the Jaipur State) more or less hilly, and has a climate and a flora resembling those of Central India and the North-Western Provinces. Where not actually hilly, the surface is, to a considerable extent, undulating. Cultivation is, on the whole, scanty, and is chiefly confined to the lower and flatter lands, while the higher parts remain to a large extent covered with their original vegetation, and on them may be found in abundance plants which, in the more completely cultivated provinces of North-Western India, are confined to the comparatively small tracts of waste and unreclaimed land.

As is the case in other parts of India with a similar vegetation, the majority of the trees and shrubs come into flower during the hot season, while the herbaceous plants blossom chiefly during the rains. Many of the latter are, moreover, annuals which wither and die as the cold season approaches. The cold season corresponds to the winter of temperate countries, and during the whole of it the aspect of the uncultivated parts of the country is brown and barren. The flowering of the shrubs and trees during the hot weather does little towards increasing the beauty of the scenery. On the contrary, it, if anything, intensifies the feeling of barrenness and aridity. With the first fall of rain, myriads of seeds that had lain dormant in the parched soil spring into life, and in the course of an incredibly short time the whole of the country, even to the tops of the barest hills, is clad in a carpet of delicate green, while the pleasant sound of running water can actually be heard in the valleys. The largest tree of this part of Rajputana is the Sémul (*Bombax malabaricum*), which, on the Arvalis and Aboo, attains a considerable size. The finely buttressed grey trunk, spreading arms, and gaudy red flowers of this species

make it a striking object in the landscape wherever it occurs. Ranking after the Semul in size are *Prosopis spicigera*, *Sterculia urens*, *Semecarpus Anacardium*, the two *Acacias* (*leucophlœa* and *Catechu*), *Anogeissus latifolia* and *pendula*, *Dichrostachys cinerea*, *Grædia Rothii*, *O. Myza*, and *Phyllanthus Emblica*. These yield both fuel and building timber in parts of the region where neither is over-abundant. *Erythrina suberosa*, with its ungainly trunk and branches but handsome scarlet flowers, and the pretty geranium tree of the Anglo-Indian (*Bauhinia purpurea*), are not uncommon. *Gmelina arborea*, a tree which yields an excellent timber, and which occurs over almost the whole of India and Burma, is found sparingly in the Arvalis. The gum-yielding salai tree (*Boswellia thurifera*), so abundant in the territory to the eastward of the tract, is not uncommon in Meywar and the Arvalis. The dâk or pallâs (*Butea frondosa*), which in various parts of Central India covers immense areas to the exclusion of pretty nearly every other tree, is far from abundant in any part of the region. Two *Terminalias* (*tomentosa* and *Arjuna*), both valuable as timber trees, occur sparingly on the eastern frontier of the tract, but are rare elsewhere. *Schrebera swietenoides*, a little-known and rather rare tree, has been found by Dr. Brandis in Meywar.

Climbing plants are not numerous, the most notable being two species of *Cocculus* (*villosus* and *Leæba*), *Cissampelos Pareira*, *Celastrus puncicalatus*, two vines (*Vitis carnosâ* and *Vitis latifolia*), and *Mimosa rubicaulis*.

The shrubby vegetation, which in every part of the region is so much more prominent than the arboreal, consists largely of capers, jujubes, tamarisks, and *Grewias*. Of the capers by far the commonest is *Capparis aphylla*, a prickly leafless shrub with a handsome plum-like fruit, which flourishes over all the driest parts of North-Western India, and extends to Arabia, Nubia, and Egypt; *Capparis spinosa* (which yields the eatable caper) is much less frequent; *Capparis horrida*, a scrambling plant which often climbs on trees, is not uncommon; while a fourth species *Capparis sepiaria* (indigenous in the south of India), is here and there cultivated as a hedge plant. The small jujube (*Zizyphus nummularia*) is very abundant, and, covering, as it often does, large tracts of country, has great value as a fodder plant: it is also much used for hedges. *Zizyphus xylopyra* is a less abundant species, which sometimes, in protected spots, attains to the dignity of a small tree and yields a useful wood, while its bark is used in tanning. In every water-course tamarisks of several species abound. One of these (*Tamarix gallica*) is a cosmopolitan plant, which is found in suitable localities all over India and Ceylon, in China, Japan, and Siberia; specimens of it have been gathered in Yarkand, in Thibet, at 11,000 feet above the sea, and it is common in many parts of Northern

Africa and Southern Europe. *Tamarix dioica*, an exclusively Indian species, is also abundant. Of the *Grewias*, *Grewia populifolia*, *Grewia pilosa*, *Grewia villosa*, and *Grewia salvifolia* are the common species. These all yield tough wood, which, however, is rarely large enough to be of much use; and the fruits of all four are more or less eatable. In addition to these, the most notable shrubs are *Helicteres Isora*, the curious spirally curled seed-vessels of which have a fanciful value as a remedy in dysentery; *Celastrus spinosus* and *Celastrus senegalensis*, *Buchanania latifolia*, *Cassia auriculata*, *Woodfordia floribunda* (the scarlet flowers of which are used as a dye), *Casearia tomentosa*, *Diospyros montana*, *Holarrhena antidysenterica* (named from its reputed value as a cure for dysentery), *Calotropis procera*, *Vitex Negundo* (esteemed as a remedy for rheumatism), and *Glerodendron phlomoides*. Two cactus-like fleshy *Euphorbias* (*Euphorbia Royleana* and *Euphorbia nerifolia*) occur in the hills, but are much less abundant than in the tract to the west of the Arvalis. Bamboos are represented by a single species (*Dendrocalamus strictus*), which attains large dimensions only on Aboo and the higher parts of the Arvalis.

The herbaceous vegetation consists of *Leguminosæ* of the genera *Alysicarpus*, *Desmodium*, *Orotalaria*, *Cassia*, &c., of various widely distributed species of *Compositæ* and *Rubiaceæ*; *Boraginaceæ* being also rather numerous, and *Scrophulariaceæ* less so. During the rains a few *Convolvulaceæ* appear, and grasses and sedges are abundant.

Owing to its heavy rainfall, Aboo is, as regards vegetation, by far the richest spot in Rajputana. On the higher parts of the mountain, humid types appear which are unknown on the plains below. Most noteworthy of these is an epiphytal orchid (a species of *Aerides*) which clings to the mango trees, and in the rains produces fine racemes of delicate pink flowers. The occurrence of a charming white wild rose and of a stinging nettle (*Girardinia heterophylla*) also at once reminds the visitor to Aboo that he has left the arid region below, and recalls to his mind the semi-temperate vegetation of the Himalayas and Nilgiris. Magnificent trees of *Michelia Champaca* are found, especially beside the temples, and weeping willows adorn the margin of the lake near the station; but the latter two species have both doubtless been planted. A yellow jasmine (*Jasminum revolutum*) abounds on Goroo-Sikhur, the highest peak of the mountain; but this is also doubtfully indigenous. *Crataeva religiosa*, with its creamy yellow flowers and delicately-tinted stamens, is common on the middle and lower slopes of the hill; while *Carissa Carandas* is so abundant, that during part of the hot season its pretty white flowers scent the air for miles round the station with their delicious fragrance. The prevailing tree on the slopes of Aboo is the mango. It is doubtfully indigenous

and was probably originally introduced by the numerous pilgrims who have for ages frequented the sacred shrines for which the mountain is famous. Now, however, it is thoroughly naturalised, and is the commonest of the larger trees. *Pongamia glabra* is found in several of the lower valleys of Aboo (wherever it occurs on the plains below it has usually been planted) and *Sterculia colorata* is not uncommon. Shrubby and herbaceous *Acanthaceæ* of several species abound. Very common also is *Mallotus philippinensis*, the powder covering the capsules of which forms at once a valuable dye-stuff and an efficient vermifuge. On the lower slopes of the mountain, and in the dense belt of jungle which surrounds its base, are found most of the species which are characteristic of the plains. Many of the latter (for example, *Salvadora persica*) ascend to the very highest peaks of the mountain, and thus intermix with the more temperate forms which are confined to the latter.

Of introduced Indian plants which are found usually in gardens or near villages over the whole of the eastern tract, the most prominent are the peepul (*Ficus religiosa*), the banyan (*Ficus bengalensis*), the gular (*Ficus glomerata*), the ungeer (*Ficus virgata*), the mulberry (*Morus alba*), the tamarind (*Tamarindus indica*), the mango (*Mangifera indica*), the nim (*Melia Azadirachta*), the bábul (*Acacia arabica*) the ber (*Zizyphus jujuba*), the siris (*Acacia Lebbek*), the jamun (*Eugenia Jambolana*), the mehndi (*Lawsonia alba*), the pomegranate (*Punica Granatum*) and the peach (*Amygdalus persica*) *Mimusops indica* and *Elaeagnus*, *Ailanthus excelsa*, and *Placourtia Ramontchi* are also occasionally met with. The bábul is quite naturalised in spots where the winter cold is not too intense, and where the sub-soil retains a little moisture: its timber and bark are both highly prized. Among fruit trees cultivated in gardens, two American species are very common; these are the custard apple (*Anona squamosa*), and the guava (*Psidium Guava*). *Argemone mexicana*, *Parkinsonia aculeata*, *Opuntia Dillenii*, and *Acacia Farnesiana* (also introductions from America), are frequently met with. *Nerium odoratum*, a shrub closely allied to, if not identical with, the oleander of Southern Europe, is also common in gardens.

Western Rajputana.—To the westward of the Arvalis the country is much flatter and drier, and as the Sind and Punjab frontiers are approached, it passes into actual desert. It is, however, by no means destitute of hills, for numerous low ridges of a red sandstone rise here and there, and in other parts there are undulating areas of hardened sand. The rest of the country is for the most part a plain of loose sand, which, everywhere more or less saline, becomes increasingly so towards the south-west, where the Loni loses itself in the Runn of Kutch. Except that they support a few of the fleshy *Euphorbias* already mentioned

many of the hilly ridges are utterly barren. The little rain that falls on these bare rocks is at once carried off in rapid torrents which are often lost in the sand at a short distance from their bases. The few torrents which do succeed in carrying their water to any distance unite to form the Loni, the one river of this part of the country. But although water can be had by digging at certain parts of its bed at almost any season of the year, and stagnant pools may here and there be found at all times, it is only during the brief and scanty rainy season that anything like a continued current can be seen in any part of the Loni. The rainfall, which over the whole area is scanty and uncertain, gradually diminishes as the Sind and Punjab frontiers are approached. Erinpura, a station near the base of the Arvalis, has a rainfall of about 12 inches in the year; whereas Western Marwar, Jesulmir, and Bikanir have probably less than a third of that amount.

It must not be supposed that the Arvali range forms a rigid boundary separating two distinct floras; on the contrary, the majority of the plants already mentioned as characteristic of the eastern tracts are found on the west of the range. Near the base of the Arvalis, the soil is good and supports a belt of what would, for Western Rajputana, be a comparatively luxuriant vegetation, were it not ruthlessly preyed on by the inhabitants for fuel and timber for themselves and fodder for their cattle and camels. In passing westward from the Arvalis, such of the species already mentioned as are unable to withstand the increasing dryness of the climate, and the saltiness of the soil, are represented in gradually diminishing numbers by stunted, half-starved specimens, and the majority of them finally disappear altogether. On the other hand, a few species of a thoroughly desert type gradually appear, and these latter increase in proportion to the former, until on the western frontier of the region they form almost the entire vegetation. These desert plants are outliers of the Arabian and North African flora, and are common to all low-level Asiatic deserts, while some of them penetrate even to the comparatively high arid tracts of Central Asia. Next to the floral poverty of this tract, the most notable fact that strikes the observer is the tendency of plants, which in moister regions are herbaceous, here to become tough and shrubby, and of the whole vegetation to develop epidermal armature in the shape of hairs and thorns. The common weed (*Solanum Jacquinii*) which in the Gangetic plain is moderately covered with stiff bristles, here presents the appearance of a vegetable hedgehog. The spines of the *bâbul* are about twice as long and as thick as they are in Malwa, while the small *ber* bushes, everywhere formidable, are here little more than mere bundles of spines.

The largest trees in Marwar are those that have been planted in gardens and near tanks or wells. Hardly one of any indi-

genous species is ever found exceeding ten or twelve feet in height. The commonest of these latter are *Prosopis spicigera*, *Salicadora persica*, *Cordia Rothii*, *Acacia leucophlœa*, with *Acacia arabica* in the kind of spots already indicated, and *Sterculia urens* on the less barren hills. *Anogeissus pendula* and *Dichrostachys cinerea* occur but sparingly, and hardly ever exceed the dimensions of under-shrubs. Towards the Sind desert, the only tree to be found wild is said to be *Acacia rupestris*, a form almost totally absent from the eastern tract.

By far the handsomest shrub indigenous to this part of Rajputana is *Tecoma undulata*, which has the double merit of bearing large orange-coloured bell-shaped blossoms, and of bearing them simultaneously with its handsome shining leaves. This plant is so indifferent to climatic conditions that, although naturally found on some of the drier ridges of Marwar, it thrives excellently in the Botanical Garden in the steamy climate of Calcutta—a peculiarity which it shares with *Dichrostachys cinerea* and *Acacia leucophlœa*. Next to *Tecoma undulata*, the finest indigenous shrub is *Acacia Jacquemonti*, the polished stems and thorns and sweet-scented yellow flowers of which make it an object of much beauty and interest. In addition to these, the shrubby vegetation is composed of the following species already mentioned as occurring more abundantly in the eastern tract:—*Capparis aphylla* and *spinosa*; *Helicteres Isora*; *Grewia populifolia*, *pilosa*, *villosa*, and *salvifolia*; the two *Zizyphi* (*nammularia* and *xylopyra*); *Cassia auriculata*; *Clerodendron phlomoides*, and *Vitex Negundo*. The tamarisks already mentioned are found abundantly in the salt-impregnated bed of the Loni, and two other species of the same family (*Tamarix articulata* and *Myricaria germanica*) also begin to be found. Both these are common in Afghanistan and in Western Asia generally; while the second of the two extends also to high altitudes both in the Himalayas and in some of the mountain ranges of Northern Europe. *Balanites Roxburghii* (a prickly scraggy shrub common in Southern India Central Provinces, and other dry parts of India) is here pretty common. *Balsamodendron Mukul*, a shrub which yields a gum called *mukul* or *gugal*, and which extends to the dry countries far to the westward of India, begins here to be as abundant as east of the Arvalis it is rare. *Ephedra alte*, a bush common in the west of Asia and north of Africa, is said to have been found in Jestulmir. The pretty little camel-thorn (*Alhagi Maurorum*), which, occurring in the eastern tract and far beyond it in India, is also distributed in Southern Europe and Western Asia, here forms a prominent feature in the vegetation of the sandy tracts. Associated with it are a few other bushes, such as *Gulotropis procera* and *Orthanthera viminea* (both of which yield an excellent fibre), and here and there *Periploca aphylla*.

Of the herbaceous vegetation, the prominent species may be indicated as follows: *Peganum Harmala* (a rutaceous plant, which is found in the Deccan and Punjab, and which is distributed to the westward along the Mediterranean coasts as far as the Atlantic) occurs in plenty in many spots, as, for example, near Palli. *Polygala abyssinica* is not unfrequent in places. The most abundant leguminous plants are *Crotalaria Burhia* (much valued for fodder) and *Tephrosia purpurea*. *Compositæ* are represented by one or two *Blumeas*, *Vernonia cinerea*, *Microhynchus nudicaulis*, and *Berthelotia lanceolata*; here and there *Triohclepis radicans* and *Echinops echinata* are to be seen; and near irrigated spots may be met with *Machlis hemisphærica*, *Sphæranthus hirtus*, and *Cyathocline lyrata*. Not uncommon in gardens as weeds of cultivation are *Saponaria Vaccaria*, *Trianthema crystallina*, *Asphodelus fistulosus*, and *Fumaria parviflora*. Of Acanthaceous plants, the most frequent are *Lepidugathis trinervis* and *Barleria nortiflora*, with here and there two plants of wide distribution in India,—namely, *Justicia procumbens* and *Peristrophe bicalyculata*. *Boraginæ* are numerous in individuals belonging to the genera *Eritrichium* and *Arnebia*; *Trichodesmus indica* and *Tournefortia subulata* are common near Jodhpur. Several *Oleomes*, one or two *Fursetias*, two or three species of *Abutilon* and *Sida* are also common. *Tribulus terrestris*, *Corchorus depressus*, *Verbena officinalis*, *Lippia nodiflora*, *Bergia æstivosa*, *Cressa cretica*, *Convolvulus arvensis*, *Evolvulus pilosus*, *Withania somnifera*, *Colanum xanthocarpum* var. *Jacquinii*, *Salvia brachiata*, *Polygonum Roxburghii*, and *Aristolochia bracteata* are found in spots where there is a little admixture of vegetable mould, and by the margins of tanks and irrigated spots. *Amarantaceæ* are represented by *Achyranthes aspera*, *Alternanthera sessilis*, *Amaranthus lividus*, *Aerua lanata*, and *Pupalia velutina*. Such *Chenopods* as *Anabasis*, *Atriplex* and *Salsola* abound where, as towards the mouth of the Loni, the sand is highly saline. Parasitic on the roots of *Calotropis* is a pretty species of *Orobanchæ*. The tanks are not destitute of vegetation, for in their water may be found, though sparingly, *Vallisneria spiralis*, *Utricularia stellaris*, *Potamogeton pectinatus* and *natans*, while by their margins several species of sedges, and notably *Hymenochaete grossæ*, are often abundant. Several species of *Andropogon*, *Anthisteria*, *Cenchrus*, and other wiry grasses are distributed over the whole area; and towards the Sind frontier one of these, known locally as *mart*, constitutes a large proportion of the scanty vegetation. Besides this grass, the vegetation on that frontier consists almost exclusively of the small acacia tree already mentioned (*Acacia rupestris*), of a plant of the rhubarb family with curious hairy seed-vessels known locally as *phog* and botanically as *Calliognum polygonoides*, the woolly-looking plant *Aerua lanata* (locally called *bhin*), *Anabasis multiflora*, and a troublesome bur grass *Cenchrus biflorus*.

In the sandier parts of this western tract the staff of life is derived from a rain crop of millet, which is sown as soon as a shower in July or August makes it worth while to give a hurried ploughing to the patches of soil which the inhabitants are pleased to call fields. Wheat is a garden crop confined to the small patches which it is possible to irrigate from wells. In the sands of Bikanir, water-melons occur spontaneously in such numbers as to form for some months in the year no small part of the food of the scanty population. The seeds of these and of other cucurbitaceous plants cultivated in gardens are ground, during times of scarcity, into a kind of flour.

From the preceding sketch it may readily be inferred that the country is barren and infertile, and it is difficult for one who has not visited it to realise that, in spite of its many natural drawbacks, it affords sustenance to a human population of exceptionally fine physique, and is the breeding ground of some of the finest races of cattle and horses and of the best camels in India. The bullocks of Nagore are celebrated for their size and paces; the endurance of the horses of Mallani is proverbial; while the swiftest riding-camels in India are born and bred in Bikanir. It is perfectly wonderful to see the apparently bare barren plains from which these animals contrive to pick up their daily food.

As has already been remarked, the province of Rajputana does not possess a flora peculiar to itself, but rather presents a field on which the adjacent floras of dry India and of the deserts of Western Asia and Northern Africa interosculate. In other words, there are, so far as the writer is aware, no species peculiar to this area, every plant in it being found also either in the adjacent provinces of Central India, Guzerat, the Punjab, North-Western Provinces, or in the dry regions of the Deccan and Southern India; while several of them occur also in countries far beyond the limits of the Indian Empire.—[*The Indian Forester*, January 1879].

Correspondence and Selections.

On the wild Silks of India, principally Tusser.

BY THOMAS WARDLE, F. C. S., F. G. S.

[THE following paper treats on a subject which has long engaged the attention of the Agri-Horticultural Society of India. As many readers of this Journal may not see the Journal of the Society of Arts in which it appears, it is considered desirable to reprint it in a somewhat abridged form in these pages in continuation of a monograph on the same subject, which is inserted in Part I of this Volume.]

INTRODUCTION.

This interesting and important subject has received so much learned attention during the last fifty years, from both entomologists and sericulturists, that it is impossible now to treat of it in a lecture without saying much that is not absolutely new.

Whilst, therefore, abstract research may have but a narrow field left, I hope that what I have to say may be useful in stimulating a greater utilisation of these products, which are as beautiful as they are curious, and in calling the attention of manufacturers, printers, dyers, and users to some most important improvements and developments in each of their several departments, the result of a lengthened study of the exact nature of the fibres, and of new and improved modes of manufacturing and decorating them.

Amongst the many names of persons in various countries interested in the cultivation of wild silk-worms, the utilisation of their products, and in the entomology of the subject, I venture to give the following list, which will be found interesting by many, and will serve to show more forcibly to what a large extent this important subject has been made a matter for study and investigation :—

English.

Dr. Roxburgh, Captain Hutton, Mr. Hugon, Dr. Birdwood, Mr. F. Moore, Mr. P. H. Gosse, Captain Mitchell, Mr. Butler, Major Coussmaker, Lady D. Neville, Lady Gilbert, Mr. Calvert, Mr. Geoghegan, Dr. Alex. Wallace, Dr. Mackenzie, and others.

Continental.

M. Guérin Méneville, M. Personnat, M. Robert, M. Camille Mayne, M. W. Reed, M. Braine, M. Maurice Girard, M. Wailly, Wilhelm Carl Berg, M. Costa, M. Matthieu Bonagous, Mich. Judizky, Roo Van Westmas, N. H. de Graaf, Dr. Chavannes, and many others. My friend M. Rondot, member of the Chamber of Commerce, Lyons, and President of the Jury Class 34, Silks, at the Paris Exhibition last year, author of several important works of silk and Eastern dyes, is at the present time giving much economic attention to this question, for the purpose of considering supply for the increasing demand of the French silk trade in wild silks.

Amongst those who have interested themselves especially in the utilisation of these wild silks must be mentioned Dr. Birdwood, who was one of the first, if not the first, to call public attention to the importance of Tusser silk, in a lengthy report to Government in 1858, which I regret I have not time to read.

Lady Dorothy Neville is well-known by her efforts in trying to acclimatise the *ailanthus* worm, and in utilising its silk during a long series of observations of a practical nature.

Mr. Geogheghan is the author and compiler of a valuable report to the Government of India on the silk industry of India, which is indispensable to a study of the subject.

Major Coussmaker is pursuing with a praise-worthy determination, at Poonah, his culture of Tusser silk-worms, with a view of making Tusser silk as systematic an industry as that produced by *Bombyx mori* and the other mulberry silks.

Besides many others, the enthusiastic labours of the French, aided by their Société d'Acclimatation, set us a great example. They have succeeded in domesticating, if not in almost naturalising, several eastern species of wild silk producers, and in obtaining from them silk of industrial value.

Classification.

The silk-producing *Lepidopterous* insects are of many species, possessing, as is here shown, very marked structural differences, whilst the variety and quiet beauty of their colours and, with the exception of the mulberry feeders, their large size, contribute greatly to the charm of studying this branch of natural history, and they make a collection, apart from their great usefulness, worthy of being placed in the first rank.

They belong, as I have stated, to the order *Lepidoptera*, and are all members of but two families, *Bombycidae* and *Saturniidae*.

All the *Saturniidae* are silk spinners, but not all the *Bombycidae*.

The British Museum catalogue contains the names of 294 species of *Saturniidae*. Mr. Butler, of the British Museum, informs me there have been 100 more species added since the publication of the catalogue.

Mr. Frederic Moore, curator of the India Museum, the acknowledged authority on Indian wild silk moths, has kindly furnished me with a list of all the silk-producing *Lepidoptera* of India known at the present time.

The India Museum contains a collection of most of the wild silk moths, with specimens of the cocoons and the silk of their larvæ, arranged by Mr. Moore, a description of which will be found in the second volume of the catalogue on Indian *Lepidoptera*, published in 1858-9.

To illustrate my lecture, I have here to-night a very interesting collection of the moths of the greatest industrial importance, as well as the cocoons of their larvæ, and examples of their silk in most, if not all, the various stages of industrial development.

The following is Mr. Moore's list of all the known species of silk-producers in India. It is the most valuable list yet published, and shows how rich India is in silk-producing insects:—

MULBERRY-FEEDING SILK-WORMS—DOMESTICATED.

Bombyx mori (Linnaeus).—The common silk-worm, domesticated in China, Bokhara, Afghanistan, Cashmere, Persia, S. Russia, Turkey, Egypt and Algeria, Italy, France and Spain, in all which countries it produces but one crop annually, spinning the largest cocoon the best silk, of a golden yellow, or white.

Bombyx textor (Hutton).—The *Boro* (*poolloo* of Bengal, domesticated in S. China and Bengal; an annual only, producing a white (sometimes yellow) cocoon, of a different texture and more fleshy than *B. mori*.

Bombyx sinensis (Hutton).—The *Sina*, *Cheena*, or small Chinese monthly worm of Bengal, partially domesticated in Bengal, where it was introduced from China; produces several broods in the year; cocoon white and yellow.

Bombyx cræsi (Hutton).—The *Nistry* or *Madrassee* of Bengal, introduced from China; domesticated in Bengal, yielding seven or eight broods of golden yellow cocoons in the year, of larger size than *B. sinensis*.

Bombyx fortunatus (Hutton).—The *Dasee* of Bengal yields several broods annually, spinning the smallest cocoon, of a golden yellow colour.

Bombyx arracenenensis (Hutton).—The Burmese silk-worm, domesticated in Arracan, said to have been introduced from China through Burmah; yields several broods annually; cocoons larger than the Bengal monthly species.

MULBERRY-FEEDING SILK-WORMS—WILD.

Theophila Huttoni (Westwood).—The wild silk-worm of the N. W. Himalayas. A wild species, the worms being found abundantly feeding on the indigenous mulberry in the mountain forests of the N. W. Himalayas.

Theophila Sherwilli (Moore).—The wild silk-worm of the S. E. Himalayas.

Theophila Bengalensis (Hutton).—The wild silk-worm of Lower Bengal. Discovered in the neighbourhood of Calcutta, feeding on *Artocarpus lacoocha*. Found also at Ranchee in Chota Nagpore.

Theophila religiosa (Helfer).—The *Joree* of Assam and *Deo-mooga* of Cachar. Feeds on the bur tree (*Ficus Indica*) and the pipul (*F. religiosa*).

Theophila mandarina (Moore).—The wild silk-worm of Chekiang, N. China. Worms stated to feed on wild mulberry trees, spinning a white cocoon.

Ocinara lactea (Hutton).—Mussooree, N. W. Himalaya. Feeds on *Ficus venosa*, spinning a small yellow cocoon, yielding several broods during the summer.

Ocinara Moorei (Hutton).—Mussooree, N. W. Himalaya.—Also feeds on *Ficus venosa*, as well as on the wild fig, spinning a small white cocoon. It is a multivoltine.

Ocinara diaphana (Moore).—Khasia hills.

Trilocha varians (Walker).—N. and S. India.

ATLAS AND ERIA GROUP.

Attacus atlas (Linnaeus).—China, Burmah, India, Ceylon, Java. This appears to be almost omnivorous, feeding in different districts upon the shrubs and trees peculiar to them. At Mussooree it is found upon *Bradleya ornata*, *Falconeria insignis*, and several other trees; at Almora the yellow flowering barberry is said to be its favourite food. In Cachar it feeds on various other trees. Cocoon well stored with a fine silk.

Attacus Silhetica (Helfer).—Silhet.

Attacus Edwardsia (White).—Sikkim, Cherra, and Khasia hills.

Attacus cynthia (Drury).—China. Domesticated in the provinces of Shantung and Honan. Feeds on the varnish tree (*Ailanthus glandulosus*).

Attacus Ricini (Jones).—The *Eria* of Assam, and *Arindi* of Dinajpore. Domesticated in the Northern parts of Bengal (Bogra, Rungpore, and Dinajpore), in Assam and Cachar, feeding on the castor-oil plant (*Ricinus communis*), yielding seven or more crops annually. Cocoons somewhat loose and flossy, orange red, sometimes white. The so-called "Ailanthus silk-worm" of Europe—the result of a fertile hybrid between the Chinese and the Bengal species, was produced some years ago in France, by Monsieur Guéin-Mônéville, and subsequently reared, from whence it was introduced into various parts of the world.

Attacus Canningi (Hutton).—N. W. Himalayas. Common in a wild state, feeding on the leaves of *Coriaria nipalensis* and *Xanthophyllum hostile*. Cocoons hard and compactly woven, rusty orange or grey. An annual.

Attacus lunula (Walker).—Silhet.

Attacus obscurus (Butler).—Cachar. Not very common. Stated to feed on a plant called *Lood*.

Attacus Guerini (Moore).—Eastern Bengal.

ACTIAS GROUP.

Actias Selene (McLeay).—Mussooree, Sikkim, and Khasia hills; Madras. The worms feed upon *Andromeda ovalifolia*, *Coriaria nipalensis*, wild cherry and walnut, at Mussooree, and on *Odina woderi* in Madras.

Actias Sinensis (Walker).—N. China.

Actias Leto (Doubleday).—Sikkim and Khasia hills.

Actias Maenas (Doubleday).—Sikkim and Khasia hills.

Actias ignescens (Moore).—Andaman Isles.

TUSSER AND MOONGA GROUP.

~~*Antheræa mylitta*~~ (Drury); *Antheræa paphia* of authors; the *Tusser*, *Tussar* or *Tussah* silk-worm.—These well-known and valuable insects (of various undetermined species) are widely distributed over India, from east to west and north to south, on the coast, and in the Central Provinces. They feed in a wild state upon the ber (*Zizyphus jujuba*), the asun (*Terminalia alata*), the seemul (*Bombax heptaphyllum*), &c.

Antheræa mezankooria (Moore); the *Mezankoorie* silk-worm of the Assamese.—The worms which produce the mezankoorie silk are stated to feed on the addakoory (? *Tetranthera* sp.) which is abundant in Upper and Lower Assam. The silk is nearly white, its value being fifty per cent. above that of the moonga.

Antheræa nebulosa (Hutton).—This is the *Tusser* of the Sonthal jungles of Colgong. It is also found in Singbhoom, Chota Nagpore.

Antheræa Perrotteti (Guér. Mén.).—Described as being found in the districts of Pondicherry, feeding upon a species of *Zizyphus*, the jambool (*Syzygium jambolanum*), &c. Stated to produce four broods in a year.

Antheræa Andamana (Moore).—An allied species to the tusser. Inhabits the S. Andamans.

Antheræa Fritli (Moore).—Sikkim Himalayas. A common species, inhabiting the hot sub-tropical valleys below 2,000 ft. Known only as a wild species. The cocoon is stated to be similar to that of the tusser in form, but of finer silk.

Antheræa Helfer (Moore).—Sikkim Himalayas. This is a common species found in the hot valleys of Sikkim.

Antheræa Assama (Helfer).—The *Moonga* or *Mooga* of the Assamese. The moonga silk-worm feeds upon the trees known in Assam as the champa (*Michelia* sp.), the soom, kontoolva, digluttee (*Tetranthera diglottica*), the pattee shoonda (*Laurus obtusifolia*), and the Sonhalloo (*Tet. macrophylla*). It is extensively cultivated by the natives, and can be reared in houses, but is fed and thrives best in the open air and upon the trees. The silk forms an article of export from Assam, and leaves the country generally in the shape of thread.

Antheræa Roylei (Moore).—The oak-feeding silk-worm of the N. W. Himalayas. A common species, feeding on the hill oak (*Quercus incana*) of the N. W. Himalayas (Simla, Masuri, Almora). The cocoon is large and very tough, the silk being pronounced as promising, and worth cultivating. They can be reared easily in the house.

MISCELLANEOUS GROUP.

Salassa Lola (Westwood).—Sikkim Himalayas.

Rinaca Zuleika (Hope).—Sikkim.

Rhodia Newara (Moore).—Nepal (Kathmandoo). Worms feed upon a species of weeping willow. Spins a brilliant green cocoon, pendant from the twigs.

Caligulo Thibeta (Westwood).—Mussooree, N. W. Himalayas, 7,000 ft. Common, the worms feeding on *Andromeda ovalifolia*, wild pear, and the cultivated quince, forming a light, open, net-like cocoon.

Caligula Simla (Westwood).—Simla, N. W. Himalayas, 5,000 ft. Feeds on the walnut. *Salix babylonica*, wild pear, &c.; forms an open, net-like cocoon.

Caligula Cachara (Moore).—Cachar.

Neoris Huttoni (Moore).—Mussooree, N. W. Himalaya, 6,500 feet. The worms appear in April, feeding upon a species of wild pear tree; spins a thin silken cocoon.

Neoris Shadulla (Moore).—Yarkund.

Neoris Stoliezka (Felder).—Ladak.

Saturnia Cidosa (Moore).—Hot valleys of the Sikkim Himalayas.

Saturnia Grotei (Moore).—Sikkim, Himalayas.

Saturnia Lindia (Moore).—Sikkim Himalayas.

Saturnia Anna (Moore).—Sikkim, Himalayas.

Loepa katinka (Westwood).—Sikkim, 7,000 feet. Assam.

Loepa sikkima (Moore).—Hot valleys of Sikkim.

Loepa sivalica (Hutton).—Mussooree, 5,000 feet. Spins a long cocoon, pointed at each end, and of a dark greenish-grey colour.

Loepa miranda (Moore).—Sikkim, Himalayas.

Cricula trifenestrata (Helfer); the *Haumpottonæ* of the Assamese.—Noted as being very common in Assam, the worms feeding on the soom tree forming an open net-like cocoon of a beautiful yellow colour and of a rich lustre, the silk being spun in the same manner as the Eria cocoon. Occurs also in Moulmein, where the worms are stated to feed upon the cashew-nut tree (*Anacardium orientale*).

Oricula drepanoides (Moore).—Sikkim.

To this number may be added a few others which, although not of India, are well worth the attention of the Government of India for the purpose of acclimatisation there.

Antheræa Pernyi (Guér. Men.)—The oak-feeding silk-worm of Mantchouria, N. China. This is described as having been long known to the Mantchour Tartars, very large quantities of the silk being used among the Chinese. The worms feed on various species of oak (*Quercus mongolica*) &c., the cocoon differing from the tusser in form and texture. The silk is represented as strong, but with little lustre. Two crops of silk are produced in the year—a spring and autumn crop.

Antheræa Confucii (Moore).—A species allied to *Apernyi*, in inhabiting the hills in the neighbourhood of Shanghai, N. China.

Antheræa Yama-mai (Guérin Méneville).—The *Yama-mai* silk-worm of Japan.

An oak-feeding species forming a cocoon of a pale yellowish-green colour. This worm feeds on the oak, and produces excellent silk of considerable commercial value in Japan. I should strongly recommend its introduction into India. It has been acclimatised in Europe, and crossed with *Bombyx Attacus*—*Pernyi*, is successfully reared in France, the eggs hatching at almost freezing point. The silk is much cultivated and used in Japan. Its fibre is oval, and 950th of an inch thick.

Saturnia pyretorum from South China.—The worm feeds upon the *Liquidamber formosum* in Canton, Amoy, where the silk is stated to be woven into a coarse fabric.

Neoris shadulla (Moore).—Yarkund.

Theophila mandarina (Moore).—N. China.

BOMBYX MORI.

What is generally known as the silk of commerce, in both ancient and modern days, is distinguished from all others by the singular circumstance of the larvæ which produce its feeding on the leaves of the mulberry tree. The moth is therefore named *Bombyx mori*.

It must not be inferred, however, that there is only one species, as is too generally thought. Mr. F Moore assures me there is sufficient structural variation in moths, which were at one time understood as *Bombyx mori*, to constitute specific differences. The following species feed on the mulberry, and their silk is in ordinary and promiscuous use along with that of the *mori*:—

- *Bombyx sinensis* (Hutton),
- *Bombyx cræsi* (Hutton),
- *Bombyx fortunatus* (Hutton),
- *Bombyx arracensis* (Hutton),
- *Bombyx textor* (Hutton),

and no doubt several others not yet defined, but whose silk varies very much, such as that called Canton, and that called Tsatlee, although both are from China, as well as the silk from Japan, which has a thicker fibre than the Mori silk of other countries, being 1750 of an inch thick, as against 3750 of an inch of the Mori silk of Italy. The strength and tension of this and

the wild silks as well as the respective sizes of their cocoons, are given in the table of microscopic measurements which I have carefully revised for my lecture, confirming generally, but in several instances correcting those I made for my monograph for the Paris Exhibition.

I have here some beautifully-prepared Italian silks of *B. Mori*, kindly lent to me for my paper by my friend M. H. Meyer, a large silk manufacturer at Milan.

The eggs of *Bombyx mori*, and the other species of *Bombyx*, form a most important article of commerce between Japan and Europe. They are imported from thence into Italy and the South of France annually, to supply the deficiency caused by the silk-worm disease known as *pebrine*, and also to infuse, as it were, new blood. The value of the eggs is about 25s. per oz. Twelve pounds of cocoons are required to produce 1 lb. of silk. The value of the raw silk of Bengal in London is now 14s. 6d. per lb. The colour is generally of rich golden yellow of this sample, but it is also sometimes white. In China and Japan it is all white with rare exceptions.

WILD SILKS.

As far as I can learn, the only species of cocoons at present utilised in India, besides those of the several species of mulberry-feeding worms of the genus *Bombyx*, are the wild ones of the following species:—

- Attacus ricini*,
- „ *cynthia*,
- „ *atlas*,
- „ *Edwardsia*.
- Antheræa assama*, or Munga worm,
- „ *paphia*, or Tusser worm,
- „ *Perotteti*,
- „ *nebulosa*,
- „ *Roylei*,
- „ *Frithii*,
- „ *mezankooria*,
- Cricula trifenestrata*,
- And, perhaps,
- Attacus selene* and *Antheræa Helferi*.

The India localities of the four principal ones, *Ricini*, *Atlas*, *Munga*, and *Tusser*, are shown on these maps by various colourings.

THE ERIA SILK-WORM.

We now arrive at the consideration of the *Eria*, *Arindy* or *Arundi* worm, of which there are two species, *Attacus ricini* and *Attacus cynthia*, *Attacus ricini* (Boisd.) is known also under the names *Saturnia ricini* (Boisd.), and *Attacus lunula* (Walker).

Attacus ricini is a worm which feeds on the Palma Christi, or castor-oil plant, *Ricinus communis*. It is a native of Assam, and, according to Mr. Geoghegan, is found to the south-west in a track

comprising the districts of Nepal, Kumaon, Ladak, Darjeeling, Dinagepore, Rungpore, and, perhaps, parts of Bhangulpore and Purniah, and in Assam. In 1791, Sir W. Jones drew attention to this silk, and Dr. Roxburgh in 1804.

The leaves of the castor-oil plant, *Ricinus communis*, or Palma Christi, are the best and commonest food, but it will also feed on the following:—Koosool, Hindoo grass, Murkurdal, Okonnee, Gomaree, Litta pakoree, Brizonally, *Xanthozylon hostile*, *Coriaria nipalensis*, *Ailanthus glandulosa*, *Ailanthus excelsa*.

Attacus ricini is of a larger size than *Attacus cynthia*; owing probably to its freedom, and there is no doubt it is a silk-producer of great importance in India. Probably the most complete account of it is by Mr. Geoghegan, in his report on the silk industry of India, of which I avail myself to gather some useful particulars.

The *Attacus ricini*, according to Dr. Buchanan, feeds both on *Ricinus communis* and *Ricinus viridis*.

The female moth lays her eggs round a twig, and then dies. These twigs are sold in the markets covered with eggs, the dead moths frequently hanging to them, and presenting a very curious appearance.

The caterpillar moults four times, and when fully grown, is about $3\frac{1}{2}$ inches long.

According to Mr. Hugon, the natives soften the cocoon in potash, and draw the silk off roughly with the finger and thumb, thus making a kind of spun silk. Dr. Buchanan, however, says the silk is wound on a reel in Dinagepore.

M. Guérin Méneville, however, stated in 1860, that it was impossible to reel this cocoon. I am certainly disposed to think it is quite impracticable. Still, there is a method of using it at hand, and I know of no silk better adapted for spinning.

Some of the cocoons I received from the India-office for examination I have had carded or dressed, and the result is, as is shown in this sample, a fibre of great fineness and length, which would be eagerly sought after by English and Continental spinners, if the cocoons could be collected and sent over in quantity. Owing to the very small quantity of cocoons in my possession, I am sorry I have not been able to have specimens of yarn or cloth made for my lecture, but I have here native spun yarn undyed, bleached and dyed, also native woven cloth in the undyed and dyed states, as well as specimens of prints executed on it for, I believe, the first time in its history or use. The cloth is beautifully soft.

I find no difficulty in making this silk yield to tinctorial influences, either in dyeing or printing, and I have no hesitation in predicting a great future for it, as soon as it is subjected to the better spinning appliances of Europe, and I am recommend-

ing the Government of India to give all possible encouragement to the importation of *Eria* cocoons into Europe.

Dr. Helfer, in 1837, stated in the *Journal of the Asiatic Society of Bengal*, that this worm is so productive as to give sometimes twelve broods of silk in the course of the year. The worm grows rapidly, and offers no difficulty whatever for an extensive speculation.

The industry of the natives of India should be stimulated to the gathering in of all kinds of wild silk cocoons, whether windable or not, for there is no doubt that those kinds which cannot be reeled can be most easily spun, and there is at the present moment a request on the part of silk-spinners for a much larger supply of Tusser silk cocoons and Tusser silk waste for spinning purposes, and no doubt the other wild silk cocoons would be gladly bought up, especially those of *Attacus ricini*.

Mr. Geoghegan says, with regard to the thread from cocoons of *Attacus ricini*, that a seer of 9 sicca weight (2½ lbs.) of this thread is worth from annas 12 (one shilling and six pence) to Re. 1 (two shillings), but it is very seldom sold, and the people who keep the insect in general rear no more than is just sufficient to make cloths for their own families. The cloth lasts very long, owing to which quality it is probable that some use might be found for this material in our manufactures at home.

Mr. Michael Atkinson, of Santipore, describes the cloth made of *Eria* to be of incredible durability, the life of one person being seldom sufficient to wear out a garment made of it, so that the same piece descends from mother to daughter. The thickness of this fibre is $\frac{1}{16}$ of an inch on the outside of the cocoon, and $\frac{1}{32}$ in the inner part. (For other particulars see Table.)

Mr. Hugon says that, "in Assam, the quantity of *Eria* cloth, the merchants formerly used to take away, was very considerable, but in the latter years of the Assam Rajah's rule, from the disorganised state of the country, the number of merchants gradually diminished. The quantity the country is capable of exporting under an improved management would be very large, for it forms at present the dress of the poorer classes at all seasons, and is used by the highest for winter wear. So long ago as 1769, vast quantities were being produced in the country around Guraghaut." He estimated the annual production at 1,000 maunds, or 82,000 lbs. "In the district of Duriung, the annual yield of *Eria* is 1,000 maunds, of which one-third is exported either in the form of cocoons or woven into heavy cloths (Borkapoor)." Mr. Hugon stated that, for want of a proper solvent of the gum, the natives could not reel the cocoons. Mr. Brownlow [*Journal of the Agri-Horticultural Society of India*] states that in Cachar the *Eria* or Ricini worm is trained by the Cacharis, a people living in isolated villages on the hills. They soften the

cocoons in a mixture of cow-dung and water, and they are then carried off to a spindle by the women of the tribe. This silk is dyed by the natives with lac, munjeet, and indigo.

TABLE.
OF THE DIAMETER, STRENGTH, AND TENSION OF A SINGLE FIBRE AND DIMENSIONS OF COCOON OF THE CHIEF MULBERRY AND INDIAN WILD SILKS.

Name of Worm and Silk.	Country.	Diameter in fractions of an inch.		Strength of single fibre in drams averdupois.		Tension or limit of stretch before breaking in inches of single fibre one foot long		Dimensions of cocoons in inches.
		Outside of cocoon.	Inner part of cocoon.	Outside of cocoon.	Inner part of cocoon.	Outside of cocoon.	Inner part of cocoon.	
Bombyx inori, or Mulberry Silk ...	China	$\frac{1}{150}$	$\frac{1}{150}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{1}{2}$	$1\frac{1}{2} \times 1$
	Italy	$\frac{1}{150}$	$\frac{1}{150}$	1	$1\frac{1}{4}$	$2\frac{3}{4}$	$2\frac{1}{2}$	$1\frac{1}{4} \times \frac{3}{4}$
	Japan	$\frac{1}{150}$	$\frac{1}{150}$	1	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2} \times \frac{3}{4}$
	Bengal	$\frac{2}{100}$	$\frac{2}{100}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{4} \times \frac{1}{2}$
Bombyx textor ...	India	$\frac{2}{100}$	$\frac{2}{100}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2} \times 1\frac{1}{2}$
Antheræa paphia or Tussur Silk ...	"	$\frac{1}{75}$	$\frac{1}{10}$	1	1	7	8	$1\frac{1}{2} \times \frac{1}{2}$
Attacus ricini, or Eria Silk ...	"	$\frac{1}{100}$	$\frac{1}{25}$	1	$1\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2} \times \frac{3}{4}$
Attacus cyynthia, or Ailanthus Silk ...	"	$\frac{1}{75}$	$\frac{1}{25}$	1	$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$1\frac{1}{2} \times \frac{3}{4}$
Antheræa assama or Muga Silk ...	"	$\frac{1}{25}$	$\frac{1}{80}$	1	$1\frac{3}{4}$	$2\frac{1}{2}$	3	$1\frac{3}{4} \times 1$
Actias selene ...	"	$\frac{1}{100}$	$\frac{1}{100}$	1	$1\frac{1}{4}$	2	$2\frac{1}{4}$	$3 \times 1\frac{1}{4}$
Attacus atlas ...	"	$\frac{1}{25}$	$\frac{1}{100}$	1	$1\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2} \times \frac{7}{8}$
Antheræa yama-mai	Japan	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{3}{4}$	$1\frac{1}{4}$	$2\frac{1}{2}$	3	$1\frac{1}{2} \times \frac{7}{8}$

ATTACUS CYNTHIA.

Attacus cyynthia (Drury).
Phalæna attacus cyynthia (Drury).
Phalæna cyynthia (Roxburgh).
Bombyx cyynthia (Oliver).
Samia cyynthia (Hübner).
Saturnia cyynthia (Westwood).
Saturnia arundi (Royle).
Eria of Assam (Hugon).

I have mentioned the close relationship of *Attacus cyynthia* to *Attacus ricini*.

Mr. Geoghegan says *Attacus cyynthia* occurs in a wild state throughout a great part of the Himalaya, in the Dehra Doon, and in Assam and Cachar.

In China, *Attacus Cynthia* feeds on *Ailanthus glandulosa*. During the last 20 years much study has been bestowed on the species in Europe, and it has been successfully domesticated in France, and later on in England, so much so, that this study rejoices in the name Ailanthiculture, and the breeding houses of the insect are called Ailantheries.

It is to M. Guérin-Méneville, in France, and to Lady Dorothy Neville, in England, that we are indebted for leading the way to the successful rearing of the *Attacus Cynthia*. A description of their labours will be found in a memoir by Dr. Wallace, published in 1866, in the *Journal of the Entomological Society*. Besides giving full particulars of all that relates to Ailanthiculture, Dr. Wallace describes with great minuteness his own experience in producing this silk. He received the prize offered by the Council of the Society in 1865, for an essay on "Economic Entomology."

The diameter of all the fibres in the cocoon is tolerably uniform, and about $\frac{1}{128}$ inch. The strength of the outer fibres is, however only $2\frac{1}{2}$ drams, that of the inner being $2\frac{1}{2}$ drams. The tension of the outer fibres is one inch to the foot, and of the inner $1\frac{1}{2}$ inches. All the fibres are flat and longitudinally striated and united in pairs by their edges. The cocoon is about the size of a thrush's egg, $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, and $\frac{3}{4}$ of an inch in diameter, and consists of very fine silk, rather loosely, but closely laid together. It offers great difficulty in winding, and I am not aware that this has yet been successfully accomplished, I mean commercially.

In 1864, M. Forgemol informed the Imperial Society of Acclimatisation, in France, of the particulars of a mode he had invented to reel this silk. Dr. Wallace has quoted this report, describing the method, in his memoir. I fear, however, it is not now in practical use. But whether the reeling has ever been done, or ever will be, or not, there is no doubt that a great future remains for this silk, now that spinning machinery has been so perfected. All the cocoons that could be bred, would be easily bought up by the silk spinners. The thickness of a single inner cocoon fibre is about $\frac{1}{128}$ of an inch, and an outer fibre about $\frac{1}{128}$ of an inch. Throughout the cocoons are a few pairs of fibres $\frac{1}{128}$ of an inch in diameter. The breaking strength of a single fibre is 75 grains, and the tension is about two inches for every twelve inches, i. e., a fibre twelve inches long stretches to fourteen inches before it breaks.

Attacus Cynthia came originally to India from China. In 1856 cocoons were sent by Abbe Fantoni from the province of Shan Tung in the North of China.

Successful breeding took place from these cocoons in Turin in 1857, and from these spring all those which have been since cul-

tivated in France, England and other European countries. Mr. Moore was the first to rear them in England in 1859.

The pupæ of this insect remain in the cocoon through the winter, except in those cocoons which are formed in the autumn, from which they emerge in three or four weeks. The remaining moths emerge in April, and pair in about 12 hours afterwards, and the female begins to lay her eggs almost immediately. The moths do not live long after their exit from the cocoon. About eight days is the duration of their existence in this last and perfect stage. The eggs of one female vary from 150 to 350—30 of them weigh a grain. They hatch in 12 to 18 days according to temperature. In seven days the tiny caterpillars complete their first stage by moulting, their second in five or six days after, being, up to this time, gregarious. Their third moult occurs in another six days, and their fourth and last in six days more. By this time the larvæ are four inches long, and begin to spin their cocoons. *Attacus cynthis* has two broods in the year.

ATTACUS ATLAS.

The next silk-worm to which I wish to draw your attention is the *Attacus atlas* of Linnæus, which is also known by the following names:—

- Phalœna-Attacus atlas (Linn.)
- Bombyx atlas (Fabricius).
- Saturnia silhetica (Heller.)

The imago of this species is the largest of all the silk moths. As you will see in the case, it is a grand insect. It is called in France "Le Géant des Papillons." The largest specimens measure upwards of 10 in. in expanse of wing. According to Horsfield, it feeds on the melokka (*Phyllarthus emblica*), a plant known also in India as *Kupu gaga*. Mr. Geoghegan says this silk-worm is found in Mussoorie on the *Falconeria insignia*, *Bradleya ovata*, and other plants; in Kumaon, on the barberry, where it is abundant, and also eastward to Cachar. Mr. Moore describes it as almost omniverous. Mr. P. H. Gosse has just written a most interesting life-history of this species, describing all that is known of it. His paper, from which I quote a few pertinent facts, will be found in the *Entomologist* of February and March last. He says:—

"It is a widespread species, ranging over the south and east half of Asia, continental and insular; common on the slopes of the Himalayas, and all through India to the points of both peninsulas; abundant in China; scattered over the isles of the Archipelago, from Java to the Moluccas, to Borneo and the Philippines, a range of 35° of latitude and 55° of longitude."

His efforts to breed the Atlas worm in England are described, and although he has not been very successful, owing to sickness and death in the larval stage, his account is very interesting. Captain Landy, of Surbitten, has succeeded in obtaining fifteen good cocoons from twenty-four eggs, the larvæ having been fed

on the common barberry. Mr. Gosse has fed his on the willow, others on the plum and apple-tree leaves. He states that all the family of *Saturniidae* are very polyphagous.

It is interesting to observe the micaceous or window-like spot on each of the four wings. These, although characteristic of the *Saturniidae* are almost more largely developed in *Attacus atlas* than in any other species. The French call these vitreous membranes *porte miroirs*.

There are several varieties of *Attacus atlas* which show their divergence from the type, by the variations of these fusiform window-like ornamentation. In some they are single, in others double.

The diameter of the external fibres of the cocoon is very variable, averaging about $\frac{1}{320}$ inch, whilst that of the internal fibres is more uniform, and about $\frac{1}{175}$ inch. The outer fibres are capable of supporting an average weight of $2\frac{1}{2}$ drams, and the inner $2\frac{1}{3}$ drams. The tension of the outer fibres is one inch to the foot, and the inner $1\frac{1}{4}$ inches. The fibres are flat and longitudinally striated, and united in pairs by their edges.

The egg of *Attacus atlas* is $\frac{1}{16}$ of an inch long. The larvæ moult six times. The cocoon of *Attacus atlas* is from two or three inches long, and about one inch wide at the widest part, and weighs two grammes, or the $\frac{1}{14}$ th of an ounce.

Mr. Gosse says "the colour of the cocoon is a light amber, or drab; its surface (independently of the impress of leaves) roughly granular, scarcely at all silky or floccose, except at the mouth; its substance thin, parchmenty, very firm; the interior very smooth, and even sub-glossy. The upper extremity forms a natural orifice, for the exit of the moth, made by the conveyance of a great number of silk-fibres, which are left ungummed, and are thus soft and flossy, the gummed, stiff silk passing up on one side and contracting into the cord. Thus the cocoon is not closed, like those of *Bombyx mori*, of *Telea*, of the *Antheræa*, but open, like those of *A. cynthia* of the *Samia* of the *Saturniæ*. As a result of this structure, the exit of the imago leaves no disturbance behind, no witness, no disarrangement of these soft fibres, such as is the case with *Yama-mai*, *Pernyi*, and *Mylitta*."

Mr. Geoghegan states the silk to be difficult to reel, though it reels partially if boiled with vinegar. Captain Hutton says the silk is decidedly good, and Dr. Chavannes, of Lausanne, states it to be desirable of introduction into France. He says the worm is the Fagara of China, where it has long been cultivated.

ATTACUS EDWARDSII.

In the India Museum there are two specimens of an atlas moth from Darjeeling, of an intensely dark colour, and possessing sufficient structural divergence from *Attacus atlas* to warrant Mr.

Moore's affirming it to be a distinct species. It has been named *Attacus Edwardsii*. Mr. Gosse has the following interesting note respecting it:—

"As Darjeeling is 7,000 feet above the sea, and has a climate in which rain and snow are abundant in winter, and humidity constant, it surely would not be difficult to acclimatise this noble form (be it variety or species) in the British Isles."

THE MOONGA, MOOGA, OR MUGA SILK.

I have here a silk produced from the worm known as the *Moonga*, or *Mooga*, *Antheraea assama* (Helfer), and *Saturnia assama* (Westwood). It is found in Assam, and also sparingly in the Dehra Doon, and is the next in importance to tussar. Mr. Geoghegan's description of this silk occupies three pages of the Blue-book on the silk industry of India, from which I extract the following particulars [taken from the Transactions of the Agri.-Horticultural Society of India.] :—

"The worm that gives the common fawn-coloured moonga silk, when fed on the most common plants, gives a whitish silk when fed on the leaves of other silk. The plants it feeds on are named and estimated as follows:—

"No. 1. *Champa* (*Michelia*).—The silk produced from the worm feeding on this plant gives the finest and whitest silk, used only by the rajah and great people, and is called champa patten moonga. The thread is sold at from 11 to 12 rupees a seer (11s. to 12s. per lb.)

"No. 2. *Maizankurry* (called also addakurry).—The old trees are cut down and the jungle about burnt, and the worms are fed upon the tender leaves of the offshoots for one year, when the leaves become too old and hard for the worms. Silk is sold at 6 to 7 rupees per seer (6s. to 7s. per lb.)

"No. 3. *Soom*.—This is the common tree of the vicinity; the silk from the worms fed on this gives the finest sort of fawn-coloured moonga. Silk is sold at 3½ to 4 rupees per seer (3s. 6d. to 4s. per lb.)

"No. 4. *Soonhalloo* *Tetranthera macrophylla*.—This is also a brown silk of inferior quality. This plant is most common in Dhurumpore and about Russa Chokey.

"No. 5. *Digluttee* *Tetranthera diglottica*.—This is also brown silk of inferior quality, but the worms fed on the leaves of this tree increase much in size.

"No. 6. *Pattees hoonda* *Laurus obtusifolia*.

"The moonga worm gives broods five times a year, and the cocoon is very large, but thin. I could only obtain silk, the produce of worms feeding on Nos. 3 and 4, and manufactured into cheap cloths for the lower classes.

"In this natural fawn-colour it stands washing much better than ordinary silk, keeping gloss and colour till the last."

Mr. Geoghegan, on page 114 of his "Silk Industry of India," says:—

"The cycle of the insect is thus given:—

From emergence from the egg to commencement of cocoon	30 days.
In the cocoon	20 "
As a moth	6 "
In the egg	10 "

Total ... 66 days."

In 1873, Colonel Hopkinson, the Commissioner of Assam, gave more modern figures:—

"It thence appears that the soom forests (on which the worm is chiefly fed) cover an area of about 34,000 acres, of which about 18,000 are assessed, yielding a revenue of nearly Rs. 28,000 (£2,800). By far the greater portion of the assessed area lies in the district of Sibsagar. The production of the silk is said to employ some 48,000 persons, but it is not their sole calling. The out-turn of silk is estimated at upwards of 100,000 lbs. But as it is admitted that the greater part of the silk is reserved for home manufacture, this estimate cannot be regarded as absolutely trustworthy. The price of the yarn per seer (2 lbs.) varies from Rs. 5 (10s) to Rs. 9 (18s.) in the several districts. The small portion exported goes to Calcutta and Dacca. From the former place it is said to find its way, to some extent, to Bhaugulpur and Bombay.

"The Silk Committee of the Agri.-Horticultural Society of India reported favourably on some munga silk sent down by Captain Jenkins in 1889, and expressed their opinion that the article was calculated to become of extensive and valuable use to our home manufactures."

One acre of land yields 50,000 Muga silk cocoons, which yield upwards of twelve seers (24 lbs.) of silk, price Rs. 5 per seer, or 5s. per lb.

From Mr. Hugon's description of the mode of reeling, it is evident it is of the rudest kind, and points to a remedy in the improved continental reeling appliances.

Having only a very small quantity of coarse reeled Muga silk at my disposal, my experiments with it have been limited. I find it bleaches well, is very lustrous, and takes the dye freely, better than Tusser. Here are specimens of it in the raw, boiled-off, bleached, and dyed states, and also some waste from cocoons for spinning.

The diameter of the fibres of Muga silk taken from the external part of the cocoon averages $\frac{1}{1000}$ inch, but the external fibres are very variable. The diameter of the inner and less variable fibres is $\frac{1}{1000}$ inch. The outer fibres will break with a weight of $2\frac{1}{2}$ drams on the average, but the inner will support three drams. The tension of the outer fibres averages one inch to the foot, and of the inner $1\frac{3}{4}$ inches. All the fibres are like Tusser, flat and striated, and united in pairs by their edges.

ANTHERÆA PEROTTETI.

This is described by Mr. Geoghegan as producing a strong, wiry, and brilliant silk, but requires carding. The larvæ feed in captivity, on the *Odina wodier* (Roxb.) "Undergoes four moults, and yields four crops a year." Fishing lines of this silk are said to be made in Dinapoor.

ANTHERÆA ROYLEI

Is described by the same author as being found at Darjeeling, and in the Himalayas from Kumaon to the Punjab, and feeds on *Quercus incana*. The silk is good, but not abundant, and the insect can be domesticated. Yields two or three crops a year.

TUSSER SILK.

I now come to the principal subject of my paper, the Tasar silk, called also Tusser, Tusseh, Tussah, Tussore. It is the pro-

duct of the larvæ of the moth *Antheræa paphia*, of Linnæus. It is known by the following synonyms :—

Phalæna, *Atticus paphia* (Linnæus).
Bombyx paphia (Fabricius).
Phalæna paphia (Roxburgh).
Saturnia paphia (Helfer).
Phalæna, *Attacus mylitta* (Drury).
Bombyx mylitta (Fabricius).
Antheræa mylitta (Hübner).
Attacus mylitta (Blanchard).
Saturnia mylitta (Westwood).
 Bughy silkworm moth of the Beerbhoom hills.
 Kolisurra silk-worm, moth of the Mahrattas.

There is but little doubt that this silk has been utilised for many centuries, both in India and Ghina, but I have not been able to find any account of its ancient history.

For the history and other particulars of Tusser silk I am glad to acknowledge my indebtedness to the report of Mr. Geoghegan. He attributes the derivation of the word Tusser to *tusuru*, the Hindostani for shattle, and states this caterpillar to be the most widely distributed, as well as the most important of the wild silk producers of India.

The larvæ, when fully grown, are about four inches in length ; they have twelve joints or articulations besides their extremities ; their colour is green, resembling the leaves on which they feed ; and they are marked with reddish spots, and a reddish-yellow band running lengthways. They feed on several plants :—

Rhizophora calceolaris (Linn).
Terminalia alata glabra (Assum tree).
Terminalia tomentosa (the saj tree).
Terminalia catappa (country almond tree).
Tectona grandis (teak tree).
Zizyphus jujuba (ber tree).
Shorea robusta (sal tree).
Bombax heptaphyllum (Semul).
Careya spherica.
Pentaptera tomentosa.
Pentaptera glabra.
Ricinus communis (castor-oil plant).
 ..Cassia lanceolata.

In six weeks from the time they are hatched they begin to spin their cocoons, which they most curiously suspend from the branches of the trees, by constructing a thick, hard cord or pedicle of silky matter, which is made to grasp the branches, as seen in these specimens.

Tusser silk is found, as you will see by the map, over nearly the whole of India.

In the Central Provinces, Mr Geoghegan says, Tusser is utilised in Raipose, Bilaspore, Sumbulpore, the Upper Godaverys, Chauda, Bhundora, Nagpore, Balaghab, Seonee, Chindwara,

Betool, and Narsinghpore, Sumbulpore is said to yield 3,500 seer, (7,000 lbs.) of silk; Raipori, 60,000 (120,000 lbs.); Bilaspore 900 (1,800 lbs.); and Chanda, 22,500 (45,000 lbs.). The silk is woven and used in the provinces in mixed fabrics of cotton wool and Tusser weft. But, at any rate, in some districts, muktahs, garments worn by Bramins after bathing, cholees, women's bodices, and doputtas and dorwas, seem to be made of pure Tusser silk.

Captain Brooke says:—

"In Seonee a regularly organised and thoroughly understood industry, from the rearing of the insects to the weaving of silk into cloth, with all its accompanying machinery of trade guilds, money-lenders, &c. This state of things is, in my opinion, no disadvantage; for, in place of having to contend with the difficulties which in India, always surround the introduction of anything new or unknown, the demand is all that is necessary to stimulate production to any extent required. Nor is this a figure of speech, for the natural food of the Tusser worm as the leaves of the saj, lendeya, and dhowra trees, all of which are found in every part of this district, and are, I believe, common to the whole of Goudwana. These trees are, besides, propagated with facility, and, as far as the requirement of the silk insect goes, are of rapid growth; hence, if the silk became more known and better valued, and the profits sufficiently attractive, we might witness a development of the culture similar in kind to that which has of late years taken place in the case of cotton. Supposing, then, a demand to spring up, I am of opinion that the supply would, in a very short time, amply meet it. The nucleus of no inconsiderable trade now exists, and only awaits the stimulus of high prices. The primary question, whether the product is, or may become, of such value as to occasion a large demand, is, one perhaps, that more nearly concerns traders than Indian administrations; still, so convinced am I of the value and beauty of the fabric that can be woven from well-reeled Tasar, that I would venture to strongly urge Government action in introducing it to the markets of Europe."

The worms require protection from birds and ants, which are their greatest enemies. The first cocoons are made in August, and are sold, after the moth has escaped, to the silk dealers at 4 to 8 pice ($1\frac{1}{2}$ d. to 3 d.) the hundred. The unpierced cocoons are only sold to rearers as seed, at 1-8 rupees to 2 rupees (3s. to 4s.) per hundred.

The caterpillars moult five times, at intervals of from five to eight days. When first hatched they weigh but $\frac{1}{16}$ th of a grain, and are about $\frac{1}{4}$ inch long; but at the end of their larval existence, which is from forty to forty-five days, they have attained a size of seven inches long, one inch in diameter, and weigh about 370 grains. They then begin to spin their cocoons, which are, as you see, of an egg shape, and silvery drab in colour. The silk is all regularly deposited in a compact manner, resembling in thickness and substance the shell of an egg.

The cocoons vary much in size. The largest I have seen are from Sumbulpore, and are two inches long and $1\frac{1}{2}$ inches in diameter, whilst smaller ones are not more than $1\frac{1}{2}$ inches long

and $\frac{1}{8}$ inch in diameter. The weight of the large cocoons is without the pupa and supporting pedicle, 28 grains; the smaller ones 8 grains. I have here an unbroken double thread reeled for me, from one cocoon, by Mr. H. Meyer, of Milan. It weighs 12 grains, and measures 1,332 yards or a little more than three-quarters of a mile.

After eight or nine months in the pupa state, a moist spot is observed at one end of the cocoon. The moth is now about to emerge both from its pupa shell and from the cocoon. It secretes an acid fluid, which softens the cement of the cocoon, and enables it to separate the fibres sufficiently to allow its creeping out, it being, no doubt, assisted in this by its short pointed spines. The head of the moth first appearing with its antennæ, broad in the male, and narrow in the female, thus enabling the observer to note the sex, and to put them in pairs. The male moth generally flies away, the night of his exit from the cocoon after his wings become extended and dried. The female rarely does, but during the first three days of her existence she lays her eggs, which hatch in about twelve days afterwards. The new life of the moth does not extend to more than eleven days. As you will see from the specimens in the case, the moth is a fine and handsome insect, measuring across the wings about six inches in the male, and about five inches in the female. You will notice the similar vitreous and transparent wing spots to those of the Atlas moth. These spots are regarded with superstitious reverence by the natives, who see in them a resemblance to the chakra or discus of the god Vishnu, and are therefore induced to consider the moth a sacred insect.

In Bengal, the cocoons are put into boiling water to kill the pupæ; in some districts, when intended for sale, they are put in boiling water and dried in the sun. In the Nizam's country the cocoons are loaded with dhobee's earth and alkaline ashes to make the reel. In the Midnapoor district, they are boiled in cow-dung and reeled by hand.

Capt. Brook says that, in Seonee, the pierced cocoons are wound, and that no koshtee rejects a cocoon simply because the moth has eaten its way through it. He has fallen into an error as to the moth's mode of exit from its cocoon. It separates the fibres with its legs and wing spine, and so creeps out. It has neither teeth nor mouth proper.

Each species of silk-worm has two stores of silk, one on each side of the alimentary canal, and below its mouth it has two so-called spinnarets or orifices, through which the silk issues simultaneously in fine parallel filaments. As the silk is drawn out of the stores, the worm coats it with a varnish technically called gum, which contains a brownish yellow colouring matter. The Tusser worm, in spinning his cocoon, takes short sweeps-

of his head from side to side, depositing the silk very closely in parallel fibres as he does so. It has been thought that the worm twists the silk as it exudes it, but this is not the case. Besides the gum which coats the silk, the worm secretes at intervals a cementing fluid, which it kneads by an expanding motion of its body through the whole cocoon to consolidate and harden it. This cement gives to the cocoon its drab colour.

There is a striking peculiarity about the fibre of Tusser silk. I have carefully and thoroughly examined it many times under the microscope, and find undoubtedly that the fibre is flat and not round like mulberry silk.

There is no doubt that it is to this property that Tusser silk owes its glassy or vitreous look, reflecting a little glare of light from the angle of incidence on its flat surface, whilst the mulberry silk fibre, being round, reflects the light equally in all directions.

By some this property is considered a drawback, but by the time the fibre has become modified, and the flatness diffused in the loom, I think the lustre of the cloth is enhanced by it.

This tape-like appearance gives the fibre this disadvantage, that it is less homogeneous than the round fibre of the mulberry silk, and I find an undoubted tendency in it to split up into smaller fibrils, thus causing the silk to swell out when subjected to severe dyeing processes, particularly the bleaching one of recent date, thus giving a substantial and important reason why its coloured cements should be removed by gentle action.

The fibrils have a distinct structure, upwards of twenty in number, and seem compactly laid together, showing the striated longitudinal appearance of the fibre under the microscope. I dare say it is this fibrous compound structure, absent, as you see, in the mulberry fibre, which is an element in its dye-resisting power. I found permanganate of potash to be the best agent to separate these fibrils.

Leaving now the more beaten track of the natural history side of the question, I come to speak of its merchantable and art side. Finding, many years ago, that Tusser silk opposed a resistance in no ordinary degree to tinctorial matter, I took an interest in the subject with a view of overcoming this resistance. In its small affinity, ordinarily speaking, for colouring matter, it ranks with the vegetable fibres of cotton and flax, and whilst, in many processes, it would come out scarcely tinted, the mulberry-bred silk would be found to have seized the colour with avidity.

It, however, takes the aniline dyes, under certain conditions, moderately well. At that time, and for some years previously, little Tusser silk had passed through the dye-houses. About forty years ago an attempt was made to introduce it in Macclesfield for sewing silk for black, but, on account of its irregular

way of taking the dye, it was abandoned. Mr. David Clarke, of Macclesfield, at that time, with his father, Mr. Jeremiah Clarke, were much interested in bringing it to the front; but as Mr. D. Clarke informs me, the second parcel not coming from the dyer in a saleable state, a costly trial took place at Chester to determine whether the blame lay with the dyer or the silk. I believe it was decided in favour of the manufacturer, and against the dyer, who, unfortunately for him, had succeeded in dyeing the sample parcel successfully. However, the result was that little or no Tusser silk has been used for sewing purposes from that day to this. About twelve years ago I made many experiments in dyeing this silk, and had the satisfaction of seeing my way to further utilisation and improvement. In 1873, the firm of which I am senior partner, consisting of my brother and myself, exhibited, at the International Exhibition at South Kensington, the result of progress up to that time, in a series of black and coloured silks, which were in advance of any similar effort, either English or Continental, as far as my observations or knowledge extended, and they attracted a good deal of attention and led to a further utilisation of Tusser silk, then a drug in the market, except for dress silks for women and girls in the undyed and pleasing shade natural to it, which is fawn colour.

The development up to that time had been that this silk could be dyed into any middle or dark shade of drab, slate, brown, green, violet, or dark red, whilst, to pale shades of blues, pinks, cerise, scarlet, and others, the dark natural ground colour of the silk interposed an insuperable barrier, as sulphur, or any then known bleaching agent, could not reduce the silk to a whiter state. The *desideratum* of pale shades led our quick French neighbours to study the composition of the brown colouring matter, and to find a solvent for it. The credit of this achievement must be awarded to M. Tessié du Motay, who was led to try permanganate of potash, which was at that time attracting much attention on account of its great oxidising power on organic matter. He found the brown colorant yielded to this agent. Unfortunately, the oxidising action being too violent, the fibre of the silk as well as its coloration was affected, and the silk was tendered by the time it became white enough for dyeing into pale colours, so much as to render it useless. However, a secret had been discovered, and it was this, that oxygen, under certain combining conditions, united with the colouring matter, which then became separated from the silk. The object now was to apply the oxygen under gentler conditions. This M. Tessié du Motay again succeeded in doing, and in a very ingenious way. He brought into contact with the silk an insoluble body, which, on contact, should yield up an atom of oxygen in the nascent form which should gently unite

with the fawn-coloured matter of the silk without attacking the fibre. This, although a rough method, solved the difficulty, and the silk, originally of the colour of this sample, can now be bleached in this way to that of the sample I show you, which is of a sufficiently pale ground to admit of its being dyed into any pale colour except white. The substance he found to comply with the required condition is binoxide of barium. Unfortunately the process is too expensive, and prevents an extensive utilisation of Tusser silk, but there is a probability of the principle being shortly applied by other methods, which will be at the same time cheaper and more within the legitimate sphere of dyehouse technical operation than that of M. Tessié du Motay, I mean, whereby the nascent oxygen shall be presented to the silk in the vat from a solution, instead of from a solid, as at present.

In 1874 I had the honour to receive a communication from Sir Louis Mallet, Under Secretary of State for India, asking me to communicate, "for the information of the Government of India, any details I might be in a position to furnish on the subject of dyeing the wild silk produced by the Tusser worm."

On my report being received, I was requested to make a full investigation of the subject, which divided itself naturally into two heads, a consideration of the silk, and of tinctorial matters. For the first, I found the raw silk as it comes into this country to be prepared by the natives of India and China in such a rude and filthy state as to interpose unnecessary obstacles to its taking the dyes. I felt sure that cleaner and more skilful methods of reeling and preparing the silk for the market, would be accompanied by less resistance to tinctorial matter, as well as furnishing a greatly improved quality. At my request, orders were issued for the collection in the different provinces of India of a complete assortment of native dyestuffs as well as a supply of Tusser silk.

In recommending the Government of India to have the natives taught the dyeing of their wild silks with dyestuffs indigenous to India, I had two motives, one to prevent the native art of India being tampered with by the introduction of European fugitive dyes and crude colours, and another that they could be made to utilise, what their country has ever been so rich in the remarkable variety of native-grown dyestuffs which in other than wild silk fabrics, they have known probably for thousands of years so well how to use. To take dyestuffs to India must surely be carrying coals to Newcastle. I have since received an extensive and most interesting series of India dyestuffs and tanning materials, which I have at present under examination. I also received a quantity of Tusser cocoons, and, not being able to have them reeled in England, I was authorised to go to Italy to see if I could have them reeled there

and effect my hope for improvement in the manufacture. By the introduction of a friend, I obtained permission to visit one of the filatures in Piedmont, that of Messrs. Gaddum and Co. On arriving there I found an extensive mulberry silk reeling and throwing establishment, situated in a most beautiful valley, in one of the southern spurs of the Alps, about three hours' journey north of Turin.

On explaining my mission, and showing the wild cocoons, I was told there was not much chance of success, for they had several times tried them, and had found them difficult to soften, and impracticable to work; but knowing too well how natural is the tendency of mankind, in any new idea, to suggest objections rather than the means, I asked for permission to be allowed to try myself. The permission being generously granted, and every assistance kindly afforded me, I was taken to the reeling room, where about 100 young women were at work, with well-trained fingers, reeling the small Piedmont cocoons of *Bombyx mori*. The operation was interesting in the extreme, heightened as it was by their strange singing of old French songs, in a dialect not even understood by the Italians, a strange and all but forgotten tongue, which has to be learned by the mill-overlookers before they can communicate their instructions to them. I was told these girls were the descendants of Huguenot refugees, escaped probably from Provence to the Italian side of the Alps, at the Revocation of the Edict of Nantes, and that they still retained their patois and their folk lore; they worked hard for the few months of cocoon reeling, from five in the morning until eight at night, for a franc a day; after work dancing and singing for the hour before bed time in the most joyous way. Apartments are provided for them at the factory, and when the reeling season is over, they separate and return to their Alpine villages, to wait for the next season's work.

The operation of unwinding silk from the cocoon is as follows:—A number of cocoons are immersed in an iron pan, in water, nearly boiling, with a little alkali to soften them. A semi-rotating brush is placed over them, which quickly catches the exterior fibres of each cocoon, and the more readily enables the reeler to find the windable thread. They are then taken out and transferred to the reeler, who sits leaning over an iron pan of about 12 inches in diameter, in which she has a few cocoons in hot water the found ends of several being in one hand. Four or six cocoons, as the case may be, are being simultaneously reeled into a single thread by the reel at her back which draws off over her head the cocoon threads, they dancing and turning in the water. When a thread breaks, or the cocoon is reeled, another is quickly presented from the lot in the other hand, the manipulation being one of great dexterity. Several years are required to

attain proficiency, and it is not until the fifth to the seventh year that a reeler is entrusted with the most delicate reeling; the keeping of the size of the thread regular and free from rough places being the most important care.

It is this branch of the manufacture that in Tusser silk is so defectively treated in India, the reeling being done in some instances round the naked knee cap, but generally with this hand reel.

I took some of my wild cocoons, and, with much difficulty and patience, after several trials, succeeded in softening them by the aid of long-continued boiling in water, to which was added soap, potash, and glycerine. When soft enough, one of the most skilled girls was told off to reel them for me, and, after ridding the cocoons of the outer and coarser threads, she reeled the thread of four cocoons into one, almost without a break, much to her own delight and to the surprise of my friends and myself.

The next day, the resulting Tusser raw silk was taken to the throwing mill, and there made into Organzine and Tram, of such fineness as to surprise my friend, who said that they had no idea that Tusser silk could be made so fine, and that they should think seriously about sending a person to India to collect Tusser cocoons, that their workpeople might wind them after their mulberry crop had been finished.

The usual size—that is, thickness—of thread of Tusser raw silk of commerce is 152 to 255 deniers—that is, skeins of 1,000 yards long, weighing 9 to 15 drams. From some of the finer raw silk a size of 6 to 7 drams is obtained, but it is generally coarser. From the cocoons, the reeling of which I superintended, I obtained a size of 51 deniers, or three drams per 1,000 yards, a sample of which I have the pleasure to show you.

Here are samples of Tusser raw and thrown silk I have received from M. H. Meyer, of Milan, obtained from cocoons I sent him. The size of the raw is 23-27 deniers or $1\frac{1}{2}$ drams for 1,000 yards; the Organzine and Tram are 50-55 deniers, or 3 drams. He found some of my cocoons very difficult to reel, no doubt owing to their age, and to not having been reeled before weather exposure. Fourteen pounds and-a-half yielded one pound of raw silk. He informs me that some cocoons he has just purchased in Marseilles are larger in size than those I sent him; they are darker in colour, but reel much better. He is obtaining from ten pounds of them one pound of raw silk.

Even a finer thread might be obtained, but as the fibre is only the fifth part of an inch, or three times as thick as ordinary silk, I think 51 deniers is a good and practicable limit when native reelers can have proper appliances, and be taught to be as handy as the reelers of Italy or the south of France. I dare

say some of my hearers may remember the improvements which took place in reeling the mulberry silk of Bengal and Brutia, when superior silk and machinery were introduced, a good many years ago. Before that time Bengal silks were held in very low estimation, and were very difficult to work, but after the introduction of better appliances, Bengal silk was shown to be as capable of refinement as any other; and Brutia silk now commands, by its superior quality, the highest price in the market; and I have no doubt that, in degree, equal success lies waiting for the Tusser silk industry.

I trust I may point to this manufacturing development and great improvement with pardonable pride, more especially as I am not a manufacturer, and could scarcely expect to find untrodden ground in a domain distinct from, although allied to my own.

The new reeled silk is much lighter in colour, as you see, than native reeled, and has very much more lustre; in fact, it is the most lustrous, in the undyed state of all silks, and possesses greater strength and tension. I found, what I expected to find, that the silk thus reeled dyes much more easily, more shades and lighter ones can be dyed upon it than native reeled, it has no disagreeable smell, and only loses two ounces per pound in being cleaned for dyeing, where native reeled Tusser loses in some cases as much as six to seven ounces per pound, and never less than four to five ounces. It is as clean, to use a technical term, which means free from slubs and irregularities of thread, as ordinary silk. The cost of reeling new and good cocoons, and manufacturing them into Organzine and Tram, is about seven shillings per pound, and it is certain to make its way in many fabrics where extreme fineness is not required, and for a variety of purposes in passmenterie, trimmings, braids, scarves, broad and narrow goods. It is beginning to be largely used for these purposes in France. Its price has lately risen, whilst that of other silks has either remained stationary, or actually depreciated.

I have urged on the Government of India the importance of introducing to the natives of India the European modes of reeling cocoons, and some time ago drew their attention to an invention which simplifies and economises this operation.

Mr. Mackenzie, engineer of Milan, has introduced a Milan house of filateurs, who have invented and patented another mode of reeling, by which skilled labour is dispensed with. If this machine is pronounced by experts to be a success, there is no reason why cocoon reeling should not be carried on in any village home, as flax spinning was formerly.

M. David, the largest ribbon manufacturer in St. Etienne, seeing this improved manufacture and dyeing in the Indian

Section of the Paris Exhibition, where they were first displayed, offered to buy all the cocoons produced in India, if the price would not be more than one franc per kilogramme, a price which Dr. Birdwood assures me is reasonable. He has applied to the India Government for 2,000 kilogrammes of cocoons for experiments at his own cost. It would be a very good thing for a trade to spring up in Tusser cocoons. The natives could easily be encouraged to breed a larger supply, whilst improvements in reeling would require time, and would meet with obstacles of race, religion, and habit difficult to overcome; also the enterprise in this direction would have to be purely private and mercantile, as I think the Government of India would not enter into commercial undertakings, but would probably, and certainly ought to, give most strenuous encouragement and help to stimulate the further spread of this most interesting industry.

I was requested by Dr. Birdwood last year to exhibit the developments of which Tusser silk was capable, in the Indian Section of the Paris Exhibition. Sir P. Cunliffe Owen entered most warmly into the idea, and took the greatest interest in it throughout, giving me all the encouragement and help required to make it worthy of being represented side by side with the beautiful objects in which India had determined to assert herself. In no exhibition before had India been shown in a manner so worthy of the gorgeous East. It was the India of the artist which asserted itself at Paris—the old historic land, from which art manufactures in brocades, printed calicoes, jewellery, ivory carving, and pottery may still draw their highest aspirations. Neither had ever before been so much done for the promotion of Indian commerce. These results are entirely due to Sir P. Cunliffe Owen, and to one who so ably assisted him, Mr. P. O. Clarke.

In the wild silk exhibits which I was entrusted to bring together in this Section, not only were the improvements shown in manufacturing and dyeing, to which I have alluded, but another and more decorative phase, and one developed, so far as I can gather, for the first time in the history of either the East or the West—that of printing. It had struck me that fabrics made of Tusser silk, either of native or home manufacture, would be susceptible of much enrichment if they could be printed upon. After many fruitless attempts, I at last succeeded, and since that time I have had the satisfaction of succeeding in applying and fixing a much wider range of colours.

Thinking that designs of an Eastern type were naturally the most applicable to cloths of this wild silk, I have obtained, by the courtesy of Dr. Forbes Watson, the loan of a large series of wood-printing blocks, of native design and workmanship, from the India Museum, I have used them for printing nearly

all the illustrations of my lecture, and have placed a few on the table, to show how beautifully they are cut. In England the finer details would be in copper, but in these the hardest wood has been chosen and most skilfully cut. To complete the consistency, I have adhered to the use of native Indian colours and colouring matters. You will notice the deep rich red of the India print in madder or munjeet, the good toned and permanent indigo shades, as well as a variety of other well-known native dyes. The designs on these blocks are extremely interesting, and if I had time to exhibit the whole series of the impressions I have taken from them, I am sure you would agree with me how they abound in originality and beautiful drawing. If from this we are led to think generally of the native art of India, we may justly feel some sorrow and regret that our influence there does not tend to perpetuate it, and regret with Dr. Birdwood, as he so well describes in his handbook, that it daily deteriorates. If it were not that Sir Cunliffe Owen is sitting so near to me, I might be led to suggest whether we could not try the experiment of turning the tables somewhat, and that if we must send our art masters to India, we might at least import some from there to try to bring us into better ways.

I would call attention to the sweetness with which the colours repose on the natural and unbleached ground of the cloth, as well as the greater sharpness and depth of those printed on bleached grounds.

Many of my examples are painted in print colours, on outline printed designs, an ancient and most interesting mode of decorating cloth, which I have revived.

I think you will agree with me that the material so decorated is beautifully suited to wall hangings, curtains, coverlits, and all kinds of furniture work, and whilst not having quite the brilliancy of the mulberry silk in its printed state, it has a richer and softer surface than those of cretonnes or challis, whilst its lasting qualities are superior to those of any other material.

Messrs. Durant, of London, have kindly informed me that Tussar raw silk comes from China, and they believe the large shipments of two years ago were principally owing to the famine in the districts of productions. Scarcely a bale, they say, has come forward during the present season, nor do they expect any at the present prices. The present price of Tusser raw silk in London is 4s. 6d. per lb. The stock in London is China Tussore. It is collected in the district of Chefoo and shipped from Shanghai. The price of Indian Tussore cloth is about 2s. per yard, 34 inches wide.

There is a very large quantity of China Tusser cloth exported from London to the Colonies. An immense trade would be developed in India if better qualities were woven there.

The following table shows the state of the London market in Tusser silk for the last few years :—

Year.	Stock, Jan. 1st.	Imported.	Consumed.
	Bales.	Bales.	Bales.
1874	662	none.	168
1875	494	none.	319.
1876	175	427	174
1877	428	1,037	284
1878	1,181	897	736
1879	1,282	...	145

The Stock, February 1st, was 1,137 bales, with a consumption for January of 145 bales. Should the demand continue, at this rate the supply would be insufficient for the year if no more comes in.

The average consumption for the four years ending 1877 was 238 bales, whilst the consumption for 1878, the year that attention was drawn to it by the Paris exhibits, more than trebled itself, the purchases being 736 bales for that year.

The following table shows present prices of silks in the London market (April 18th, 1879):—

			s.	d.
China raw Tsatlee, No. 4, per lb. ...			15	6
Canton „ No. 1, „ ...			13	6
„ „ No. 4. „ ...			11	6
Japan „ Marbush, No. 2½ „ ...			16	0
Italian Organzine ...	...	...	25	0
Bengal raw ...	...	...	14	6
Brutia „ ...	...	...	23	0
Tusser „ ...	...	...	4	6

The great improvements made in this country and on the Continent of late years in carding and spinning machinery, have enabled manufacturers to utilise all the silk that could not be reeled, such as pierced cocoons and all kinds of waste silk.

There is now a great demand for Tusser and other wild silk waste, and England possesses more than sufficient machinery to spin all that can be imported.

Another form for the use of Tusser silk is the manufacture of embroidery silks, and their application to cloth by the needle. I have had manufactured a few silks, which have been arranged by my wife for illustration this evening. She has also worked a few pieces of Tusser cloth in these silks in various designs. The larger piece of embroidery, which is unfinished, is a trial piece. Mrs. Wardle began to work first with untwisted silk, which, as

may be observed at the left corner of the work, has a fluffy appearance; therefore, I recommend for embroidery purposes a slightly twisted silk, which I think will be an improvement on crewels, and possibly filozelles, and so prove a useful industry.

INDIAN CORN AND ITS VARIETIES.

AMONG the indigenous grains of the American Continent, Indian Corn (*Zea mays*) stands pre-eminently high, as regards its value to the human family as an article of food. There are many varieties of wild rice, wild oats, wild rye, and other native cereals that would go far to sustain life, but none of them can take rank with corn or maize in its now almost numberless varieties. It is this great variety that has caused doubt with some as to their having originated from anything like a single species.

Doubtless, the mere difference of latitude or length of the growing season, or mode of culture, or quality of soil, have an influence in modifying a single species and the production of variations from the original type. Be this as it may, we now have varieties that seem adapted to any phase of climate, from the torrid through the entire of the temperate zones of the earth in any land and country, though unknown to the rest of the world until the discovery of the American Continent by Europeans.

There have been numerous disputes as to the native country of the maize, some writers wishing to prove that it has an Eastern origin; but it has not been found on any antique sculpture, neither is it mentioned by any of the ancient writers as a cereal grain of Eastern climes. Climate, combined with cultivation, has produced the varieties we now find, and a very singular form of maize is found growing spontaneously in the moist forests of Paragnay. Each seed of this particular corn is wrapped in a chaffy kind of husk, which husk after two years' cultivation, disappears, and the kernels become bare like ordinary maize.

If any proof was wanting that the ancient inhabitants of the new continent were the growers of corn, we have the evidence both from North and South America. The Smithsonian Institution has an ear of corn, found deposited in an earthen vessel eleven feet under ground, in a grave with a mummy, near Arikupa, in Peru. The grains are rather sharp-pointed, small, and slightly indented at the apex, lapping one over the other, in thirteen rows. A small portion of this specimen is broken off, hence it is but four and-a-half inches long. When stationed at Camp Lincoln, Arizona, a surgeon explored some ancient rock caves near by, which were plastered in the interior and obtained several corn-cobs, two of which were preserved, and are now in the museum of the Smithsonian Institution.

One is slender and narrow, being five and one-quarter inches long; the other is thicker, but its length is only four and one-half inches. The former had ten and the latter eight rows of grains, with no more difference discernible than exists among the corn raised by all the Pueblo Indians of to-day and which certainly is the kind grown by them at the Spanish conquest of Mexico. The ruins in which the cobs were found have not been inhabited by the present Indians of the country, who are Apaches, as they believe that evil spirits hover about them, and therefore will not enter them.

Indian corn may be said to be the most universal article of food cultivated by the Indians of new Mexico, Arizona, California, Nevada and Utah, while the tribes of the Indian Territory consider this grain their staff of life. The cultivation of this corn has not been acquired by them from others. It is a matter of historical record that, when living in the Southern States, long before the white man had set foot in country, it was cultivated, and by nearly all the Indians of the present United States to a greater or less extent.

The Indians who grow it in the primitive manner, and have the original corn of America, are the Pueblos of New Mexico and Arizona. The grains vary in colour through shades of pink, blue and white, and the ears are generally rather small and slender. The blue variety is preferred for bread, and is sorted from the rest with much care, and stored by itself. The cob or ear has fourteen rows of grains, which are full and plump and is six and three-quarters long, and four and three-quarters inches around. The corn, after being reduced to meal in a stone mortar has a peculiar bluish-white appearance.

Columbus is said to have found the maize in cultivation when he landed at Cuba, and the Pilgrim Fathers on their arrival at Plymouth saw it in full cultivation as a field vegetable, the Indian tribes all raising it for their food. Some of the larger kinds grew very tall. A "tree corn," brought from China to America is of extraordinary height, but the early mandan corn and the Canada corn have exceedingly low stems; the latter matures in a few weeks time. Maize is probably, with the exception of rice, the most extensively—that is, widely, cultivated grain in the world: it extends from the Azores to the most southern part of Europe, being raised to a certain extent even in Asia Minor, Egypt, Hindostan, and China.

From these original growths have come the wonderfully varied and interesting varieties that now furnish so many of mankind as well as countless lower animals, with a most important and coveted article of food.

The hardihood of maize, the facility with which it is propagated, and the extent of the geographical range in which it thrives,

have probably contributed to throw obscurity on the history of its introduction into the different countries in which it has been naturalised. In the first volume of Ramusis, published in 1550, there is a very accurate woodcut of an ear of maize, which is thus described:—"The wonderful and famous seed called maize, of the Western India, on which one-half the world is fed. The Portuguese call it 'Meglio Zeberto,' and some of it has already come into Italy, both red and white. Above polosene de Brigo and Villabona, whole fields of both colours, red and white, are cultivated." From this, it would appear that within little more than half a century after the discovery of America, maize was already an object of extensive cultivation in some parts of Italy.

There are a couple of million farmers in the United States engaged in the raising of maize or Indian corn—spoken of, over all English-speaking America, simply as "corn." Some lands produce but 20 bushels to the acre, others 150, swelling the aggregate crop of the country to vast dimensions. The Indian corn-crop there amounts to nearly five hundred million dollars in value, and would suffice to feed not only the population of the United States but half that of Europe in addition, for a year. England now imports from 19 to 24½ million cwts. yearly, comparatively little of it for human use, though the corn-flours prepared from it are in increasing use. It is chiefly used here as a cattle-food and for starch-making. Its use was almost unknown in the United Kingdom up to the date of the potato-famine in Ireland (1846). There are delicious preparations of it for the table, in America, little known in Europe.

How rare it is to see maize on English tables as a vegetable, and how generally one meets with it in America. Several attempts have been made to introduce it into this country, but the boiled ears have never found much favour in English eyes, still it really is one of the most nutritive of vegetables, and the "wrinkled kernelled sweet corn," as this especial table kind is called in New England, forms a delicious green vegetable. The ears should be cut when the grains are as large as a big marrow-fat pea, and the time for boiling is thirty minutes. There is a little amount of practice required before you can pick out the grains with your fork in the orthodox way, but our cousins across the water are not particular on this point; they eat them off the cobs. This maize is somewhat like asparagus in flavour. Green corn should be cooked on the same day it is gathered; in a few hours it loses its sweetness, which must be artificially supplied. Strip off the husks, pick out all the silk, and put the corn in boiling water; if not entirely fresh add a table-spoonful of sugar to the water, but no salt; serve on an open meat dish covered with a napkin; or you may cut it from the cob, put in plenty of butter and a little salt, and serve in a covered vegetable dish.

Maize in England should not be sown in the open before May, as our late frosts are apt to injure the crop. Sow in rows the first week in May, allowing fifteen inches from plant to plant. The soil should be rich, and do not forget to water well during the period of growth, July and August. Maize so treated will produce good green corn for table use all through October, long after peas have departed. A full grown maize plant is really a most ornamental object. It partakes of the style of tropical vegetation, the foliage is large and dark green, the internodes of the stems bright, and the joints prominent and well defined. A number of aerial rootlets, tinted with various colours, project from the lower portions of the stem, and find their way into the surface soil; these serve as cables to support the growing stalks, so it is best not to "hill" Indian corn, that is, draw the earth up into conical mounds—as some English amateur growers advise, round the stems. The white-gourd seed corn is the one so used for "huminy" and cakes. Corn cakes are a standing dish in America, and very good they are. The sort of maize, known as the "Tuscarora" is often planted to furnish the table with green cobs, but it is not so fine as the wrinkled kernelled, though there is considerably more starch in it than in the latter. The rice, or "pop corn," abounds in starch; red corn is simply a variety of the "King Philip" sort, which is so highly esteemed in New England.

Dumas in his "*Memoires de Chimie*," p. 365, observes: "Considered in its economic value, maize, according to its composition, stands in the first rank of cereals, in fact, besides its proportion of nitrogenous matter, which is nearly equal to that contained in any other grain, the pleasant and edible oil which it contains in so large a proportion adds to its other alimentary properties. In short, very few of the productions of nature contain like maize all the principles necessary for the nutrition of men and animals.

M. Payen, with but a slight difference, expresses himself nearly to the same effect. The advocacy of the more extended use of maize as human food has recently been brought before the Paris Société d'Encouragement in a learned paper by M. Fria, of Padua, in which he enters fully upon the hygienic and economic advantages of maize for food, and recommends its extended culture in the North of France. He passes under review a long list of authors of the 16th and 17th centuries, who mention the important part that this grain plays in the food sustenance of the early inhabitants of the new continent,—Father Labat, the missionary; F. Hernandez, surgeon to Philip II., king of Spain; Garcilasso de la Vega and Jean de Laet, historians of the New World. He then traces it down to the eminent men who eulogize it in the 19th century, at the head of whom stands

Permentier. He gives extracts from the celebrated treatise on maize of the illustrious agriculturist of Montdidier, which was rewarded by the Academy of Bourdeaux.

F. de Neufchateau wrote a supplement to the celebrated memoir of Permentier, on the culture of maize. Lelieur, Rumford, Duchesne, Bonafons, Cobbet, and many other writers on maize are quoted by M. Fria. The writer disputes the arguments of M. Best Penot, who recommends in grinding maize the removal of certain portions, such as the oily and resinous matters which give an unpleasant taste to the flour. On the contrary he advocates the use of the whole meal without any separation. Still he considers a mixture of half maize and half wheat flour useful for making bread, such as is purchased in many towns of Italy, especially Turin and Milan, which furnishes a healthy and economic food for the working classes.

According to M. Lelieur, director, of farms and royal parks, Louis XVIII. was very fond of maize bread. Washington also ate it constantly.

M. Fria expresses his astonishment that maize is not more utilised in the hospitals and other public establishments supported by the State. If the Public Assistance establishments were more enlightened on the nutritive qualities of maize, they could introduce this economic food with great advantage. A report on the subject was very recently submitted to the Academy of Medicine by Prof. Eubler.

The maize plant is affected in a remarkable degree by climate and soil; but it soon adapts itself to a locality, and by continuous cultivation from the same seed, year after year, a local variety or strain becomes established. Though all the kinds of maize in cultivation, at least in the United States, are regarded as of one species, the varieties are almost endless. These are produced not only by local influences but by selection. It is one of the species in which any peculiarity may be readily fixed in a few years by carefully selecting and sowing seeds from those plants which have the desirable features most strongly marked.

In respect to size, there are varieties from two or three feet high up to fifteen and eighteen feet, with the stalks and leaves large in proportion. The ears vary very greatly in size and number of rows of kernels, which sometimes reach twenty-four, thirty-two, or more. The grain presents a great variety in colour, from white through various shades of yellow or orange, red, brown, violet, purple, and black. By the crossing of varieties kernels of two or more colours in stripes and blotches are produced. In the Tuscarora and some others the grain is dull and opaque, while in the so-called "flint" varieties the mass of the grain, the albumen, is translucent: the opaque kinds are very starchy, while the others contain large proportions of fatty

matter. In the varieties known as "sweet corn" the grain is very much wrinkled and shrivelled: in these the conversion of sugar into starch is arrested, and the kernel does not fill out.

Indian corn may be regarded as a universal crop in the States, raised to a greater or less extent on every farm. It is extensively used as a bread material, and as such it is nutritious, healthful and quite palatable when the habit of its use is acquired. In the form of hominy it has to a great extent displaced rice, being more nutritious and palatable. Corn is essentially the food grain of stock in the States. Cattle, horses and hogs are fed on it, either in the grain or ground, and mixed in various forms. Indian corn furnishes a large amount of forage, equal in nutritive qualities to ordinary hay, and relished fully as well especially by cattle. This grain requires a deep rich loam, well pulverized and relieved of surplus water. After the ground is thus prepared, the grain is planted in "hills," so as to form straight lines in two directions, from three-and-a-half to four feet apart, and three or four stalks are cultivated in each hill. This planting is usually done by horse power, with an ingenious implement which drops the seed and covers it at the same operation. Sometimes the seed is planted in drills from four to four-and-a-half feet apart, planting a grain at intervals of ten or twelve inches in the row. This is also performed by appropriate machinery worked by horses.

The corn crop is planted in the month of May; in the southern counties a little earlier; but as corn requires a temperature of about 60° F. to produce germination, very early planting is hazardous. After the young corn has appeared, the cultivation commences, and about once a week for four or five weeks, the spaces between the rows are thoroughly stirred with the cultivator, or small plough. After this the growth is very rapid, and by the 1st of August the stalks have attained their full height, and the ears are formed. On good soil, well cultivated, corn stalks attain a height of from ten to fifteen feet in Indiana, and the crop is expected to yield from thirty to eighty bushels of grain (fifty-eight pounds per bushel) per acre. If it fall below the minimum figure, the crop is regarded as a partial failure, and if it exceed the maximum, it is considered an extra crop. Corn planted in May ripens in that latitude in September, but if the growth be healthy, the luxuriant foliage of the corn plant will yet be green, while the grain is quite hard. In this condition the crop may be cut and set up in shocks to cure. The grain will suffer little or nothing if the cutting be not done too early and a large amount of excellent forage be thus secured. But farmers seldom avail themselves of this resource, except when the hay crop fails. Usually the crop remains in the field

till November, when the ears alone are gathered; and put into open bins or cribs to dry. After a few weeks the corn is ready for the market, that portion of the crop, however, which is used for fattening pork and beef for the winter market is usually fed directly from the field, being gathered from day to day as it is needed. No systematic method of manuring has as yet been adopted in corn culture in the States. The virgin soil, rich in both mineral and organic elements of plant food, does not seem to need manure; but the time is near when this matter will demand attention. Indian corn is a gross feeder and a vigorous grower, and cannot long be cultivated on any soil without exhaustion.

The total production of maize in the United States in the Calendar year 1877 was 1,342,558,000 bushels. The average weight of the bushel is 56lbs. The total area on which the crop was grown was 50,369,113 acres. The total value of the crop (averaged at 35.8 cents the bushel) 480,643,400 dols. The average value of the yield per acre 9 dols. 54 cents. The consumption is in the proportion of 26 bushels per head of the population, but it is chiefly fed to live stock. The quantity consumed was 1,257,110,325 bushels, and the quantity exported in 1878, 85,461,098 bushels, besides 432,753 barrels of corn meal.

The quantity of maize exported in the form of grain and of corn meal is much less than the quantity consumed by animals, constituting the exports of live animals and provisions. A considerable quantity of Indian corn also enters into the American exports of spirits.

During the ten years from 1850 to 1859, inclusive, the average annual exports of corn and corn meal from the United States amounted to 6,453,775 bushels; during the ten years from 1860 to 1869, inclusive, the annual average quantity exported amounted to 11,284,035 bushels; and during the nine years from 1870 to 1878, inclusive, the annual average quantity exported amounted to 40,606,838 bushels.

It is estimated that the acreage devoted to the production of Indian corn in the United States increased above 30 per cent. from 1870 to 1877, while the increase of production is estimated to have been about 20 per cent.

The rapid extension of Indian corn culture in the States has increased the pork supply very much beyond the requirements of home consumption, leaving a yearly increasing surplus for export to foreign countries. The falling off in the price of corn seems to have corresponded nearly with that of pork and pork products; the export price of the former having fallen from 93 cents per bushel in 1870 to 56.2 cents in 1878.

Correspondence and Selections.

Notes on some neglected Fibres.

While attention is deservedly bestowed upon the introduction of well-known fibre-plants, such as cotton, into new spheres of growth there is, perhaps, too little disposition to search out and make the most of the fibrous qualities of other plants, found flourishing in a wild state in many parts of the world.

Those who have studied the subject, as several distinguished members of the Society of Arts have done, are aware of the profusion of plants whose fibres are utilised more or less by the natives of the lands where they grow, and which might be made to serve the pressing needs of civilised countries for textiles, ropes, and especially paper.

Most useful work has been done by Dr. Hermann Grothe, of Berlin, in making the humbler fibre-plants more generally known, in a little pamphlet embodying his observations on the vegetable fibres shown at the exhibitions held in London, St. Petersburg, Naples, Copenhagen, Amsterdam, Moscow, Milan, Vienna, Philadelphia, Paris, &c. Mainly from this pamphlet, the following notes have been condensed:—

SEED-HAIRS.

In this section, the *Bombax* species is one of the most important, including *B. Ceiba*, *B. heptaphyllum*, *B. malabaricum*, *B. hibiscifolium* (Venezuela), *B. munguba*, *B. carolinum*, and *B. pentandrum*. In Java, the capsules of *B. Ceiba* are gathered, and the seed-hairs are employed in stuffing and textiles, while the seeds are pressed for their oil. Similar use is made of the other species in Japan, Brazil, Guiana, Bourbon, Nicaragua, Venezuela, &c., under the local names, "édredon végétale," "patte de lièvre," "paina limpa," "barrigada," "soie de fromager," "gatillo," "pluma samanma," "ouate végétale." Closely allied are the seed-hairs of *Ochroma Lagopus*, *Eriodendron gossypium*, *E. caribæum* (Cuba and Porto Rico), *E. samauma* (on the Amazon), *E. anfractuosum* (Portuguese Africa), and *Chorisia speciosa* and *C. crispifolia* (especially in Brazil); *Stephanotis Gamolobus*, and *Fisheria* (in Brazil); also *Calotropis gigantea*, *C. Cornuti* (Senegal), *Strophanthus*, *Pladera*, *Pachira princeps*,

Rupellia, *Ichnocarpus*, *Sterculia caribæa*, *Echites*, *Morrenia brachystephana* ("tasi," in the Argentine Republic); *Cochlospermum gossypium* (E. Indies), *Beaumontia*, *Orthanthera*, *Apocynum*, *Epi-lobium*, *Eriophoron*, *Typha angustifolia*, *T. latifolia* ("masette"), *Zamia spiralis* ("dwarf palm"), and *Celmisia coriacea*. These fibres bear, in many respects, close resemblance to the most important and valuable of their class—the common cotton; but their shortness is a drawback to their being spun, and their softness and poverty are opposed to their use in paper-making. In Amsterdam, considerable quantities, imported from Java and the Sunda Islands, are employed for stuffing pillows, cushions, and mattresses.

FIBRES OF LEAF-RIBS, ROOTS, FRUITS, &c.

Liliaceæ.—At the Cape of Good Hope, *Tritoma uvaria* and *T. recurvata* are utilised as fibre-plants. The leaves are crushed, and treated in boiling water; the fibres separate in the course of a day. The Plants have been grown in Victoria since 1876. The genus *Yucca* is indigenous to Mexico, Texas, Georgia, Florida, Central America the W. Indies, and the E. Indies. The fibres of the species *Y. gloriosa*, *Y. aloefolia*, *Y. pendula* (Algiers), *Y. angustifolia*, and *Y. filamentosa* are utilised, and pass by the name of "petre hemp." *Y. acaulis* gives a fibre called "maguey de cocuy" in Venezuela. *Dracaena draco* (W. Africa and the Canaries) affords a strong fibre. More widely used are the fibres of *Sansevieria*, called "marove" and "marwool" in the E. Indies, "moorva" in Java, "Cingalese hemp" and "bowstring hemp" in Ceylon and India, "African hemp" in Guinea and Tropical Africa. The species *S. lanuginosa*, *S. cylindrica*, and *S. zeylanica* are indigenous to the E. Indies, and grow, in the Balasore district, as well inland as on the coast. They prefer low, moist, shady, and even stony places. The leaves are about 3ft. long, and each gives 30—40 bundles of fibre. The preparation is very primitive, and the product has no place in commerce. In Africa, besides the above species, occur *S. fasciata* and *S. guineensis*. *S. angolensis* (Portuguese Africa) gives an "African hemp;" *S. longifolia* also occurs, but never in the neighbourhood of *S. angolensis*. *Astelia Banksii* and *A. Cunninghamii* (New Zealand, India, and Angola), furnish leaves respectively 4ft. and 4ft. 9 in. long, containing long and fine fibres, extracted by retting. *Cordyline australis* is cultivated for its fibrous leaves, which are macerated and digested. *C. indivisa* is said to furnish the "toi" of the Maories; the leaves are 3ft. to 4ft. 6 in. long, and about 2 in. wide. Somewhat superior is the fibre of *C. pumilio*, the "tirauriki" of the New Zealanders, which is very long and strong. The species *C. stricta*, *C. terminalis*, *C. cannaefolia*, *C. robusta*, and *C. nutans* also contribute

fibres, bearing a close resemblance to phormium fibre. They are found also in Australia, China, India, the South Sea Islands, Norfolk Island, &c. The fibres of *Dianella elegans*, *D. tasmanica*, *D. cærulea*, *D. longifolia*, *D. bambusacea*, and *D. revoluta* appear to be of great value; they are 12—20 in. long, very strong, and silky.

Iridaceæ.—*Iris* (*Moræa*) *Robinsonia* (New South Wales) affords leaves 5ft. long, from which a fibre is obtained by retting.

Amarylloidæ.—Perhaps the most important members of this family are the *Agave* and *Aloe* genera, which are very commonly confounded. The leaves of *Agave americana* (Mexico, Central America, and Venezuela) afford the natives, by retting, a fibre called "ixtle," of great strength and utility. In India, occur *A. sisalana*, *A. indica*, and *A. vivipara*, and produce "Sisal," or "grass hemp." In Africa *Aletris guineensis*, and in Java and India, *A. cantula*, are utilised. There also, and in Algiers, Spain, Mexico, Central America, &c., grows *Agave fetida* (*Fourcroya gigantea*), the tallest species, attaining a height of 45—50 ft. in Mexico, and up to 60 ft. in Algiers. In Venezuela, especially in the province of Barquisimeto, the fibre, called "cocuiza," is used for making sacks. The plant has been introduced into Cuba, Hayti, Florida, Texas, and even Europe, and its fibre has received the names of "white hemp" in Hayti, "Cuba hemp," "aloe hemp," "pita hemp." At the Philadelphia Exhibition of 1876, *Agave americana* fibre was shown from Texas, Mexico, Guatemala, Nicaragua, Venezuela, Jamaica, the Cape, Mauritius, Morocco, the E. Indies, &c. In Victoria, flourish *A. americana* and *A. gigantea*. There also, and in Queensland, occur *Doryanthes excelsa* and *D. Palmeri*, whose fibres are often confounded with that of *Fourcroya*. The fibre of a *Fourcroya* growing in Brazil is beautifully white, silky, and 3 ft. long, but weak. A fibre is extracted from *Aloe ferox* in Natal. *A. vulgaris* and *A. succatrina*, abundant in S. Europe, Asia Minor, and S. Africa, give in the Zambesi country, the "kongo" fibre of the natives.

Bromeliaceæ.—The two most important genera are *Bromelia* and *Ananassa*. The wild pineapple, under various names, the most recent of which is *Ananassa sativa*, occurs in immense quantities in N. and S. America, Mexico, Africa, India, Java, &c. The leaves afford 25—40 per cent. of fibre, which, in America alone, must amount to at least 1,200 tons annually, now wasted. *Bromelia* (now *Nilularium*) *karatas*, *B. pita*, *B. pinguin*, *B. pigna*, *B. sativa*, and *B. sagenaria*, all very closely alike (some probably identical), are found in the W. Indies, Central America, Brazil, the E. Indies, Philippines, &c. Some of the most common names of the fibre are "silk-grass," "Peru hemp" (also given to *Buonapartea Juncea* in Peru), "sinamai," "pinani," "tallinanas," "gravatha" (also given to *Bilbergia tinctoria* in Brazil), "carana."

The climber *Tillandsia usneoides* grows abundantly in Florida, Georgia, Louisiana, Texas, Central America, Guiana, Brazil, and the Argentine Republic. It is exported in large quantities from New Orleans, as a substitute for horse-hair in stuffing. The various names are "barba di velho," "caragate," "barbe espagnole," "Delta moss," "Spanish moss," "New Orleans moss."

Musaceæ.—Foremost is the genus *Musa*, of which one species, *M. textilis*, affords the well-known Manilla hemp, locally called "abacá," "oetan," "koffo," "pisangbatoe," "soetan," "lupis," "merado-koffo." It is cultivated only in the Philippines. Other species possessing useful fibres, but not turned to any account are *M. paradisiaca*, *M. ensete*, *M. sapientum*, *M. Banksii* (in Queensland), *M. mindanensis*, *M. Cavendishi*, *M. bashes* (utilised in Japan) *M. Rumphiana* (Java), *M. violacea* (Angola), *M. discolor*, *M. rosacea*, *M. ornata*, *M. troglodytarum*.

The genus *Heliconia* (Antilles) and *Strelitzia juncea* (Africa) are utilised as fibre plants. The long leaves of *Walwitschia mirabilis* (Angola and Benguela) furnish a textile fibre. *Canna indica*, *C. discolor*, *C. heliconiæfolia*, *C. macrophylla*, *C. Warczewiczii* are useful for paper-making.

Palmaceæ.—The principal fibre-yielding palms are:—*Caryota urens*, "kittool" (India and Ceylon), *O. mitis* (Réunion), *O. onusta* (Philippines); *Corypha australis*, *C. taliera*, *C. elata* (Australia and E. Indies), *C. gebanga* (Java, India, &c.), *C. umbraculifera* (Java, India, and the Philippines), *C. mitis* (Ceylon); *O. latania* (Java and India), *C. horrida* (Ceylon); *Livistona humilis* and *L. inermis* (Australia); *Arenca saccharifera* "gomuti" (Java, Siam, China, Cochin China, and W. Africa); *Raphia vinefera* and *R. Ruffia* (Madagascar), *R. angolensis* (W. Africa); *Carludovica palmata* (Brazil Colombia); *Mauritia flexuosa* (Brazil, Guiana, Colombia, and Asia), *M. vinifera* (Brazil); *Borassus flabelliformis* (India, Ceylon, Sunda Islands); *Attalea funifera*, "piassaba" (Brazil and Venezuela); *Leopoldinia Piassaba*, "piassaba" (Brazil and Venezuela); *Chamærops excelsa* and *O. humilis* (S. Europe, Algiers, Africa, China), *O. palmetto* (Louisiana and S. Carolina), *O. hystrix* (Central America); *Astrocaryum vulgare* and *A. Ayri* (Brazil); *Manicaria saccifera* (Brazil); *Momordica operculata* (Brazil); *Areca catechu* and *A. pterocarpa* (E. Indies and Sunda Islands); *Phoenix dactylifera* (S. Europe, N. Africa, Arabia, Syria, Persia, E. Indies), *P. acaulis* (Coromandel), and *P. sylvestris*; *Cocos nucifera*, "coir" (in all the tropics); *Thrinax argentea* (Cuba); *Celmisia coriacea* (Australia); *Lodoicea maldivica* (Seychelles); *Arrudaria (Corypha) cerifera* (Brazil); *Raphis flabelliformis* (Réunion); *Jubæa spectabilis* (Chili); *Hyphæa guineensis* (Angola), *H. crucifera* (Nubia); *Elæis guineensis* (W. Africa); *Nipa fruticans* (E. Indies); *Sabal mexicana* (Mexico); *Bactris setosa* (Brazil); *Platonia insignis*

(Brazil); *Lecythis ollaria* and *L. grandiflora* (Brazil); *Aerocomia sclerocarpa* (Brazil); *Diplothenium Torallii* (Australia). The genus *Calamus* is usually placed among grasses. The most common species are *S. Rotan*, *C. rudentum*, *C. erectus*, *C. verus*, *C. gracilis*, *C. Draco*, *S. Royleanus*, *C. extensus*, *C. tenuis*, *C. sipionum*. This fibre has recently been turned to account for mat-making in this country, besides the old applications to chair-seats, window-blinds, &c.

Pandanaceæ.—The genus *Pandanus* includes *P. utilis*, *P. edulis*, *P. volubilis*, *P. candelabrum*, *P. odoratissimus*, *P. pedunculatus*, *P. spiralis*. They flourish in the E. Indies, S. America, &c. The natives of Mauritius, Bourbon, &c., prepare the fibre of *P. odoratissimus* with care, and obtain a fine soft material, called "vacoa," or "bakua" (in the E. Indies "budki"), for textiles, and a stronger material for sacking. The fibre is called "palungor" in India, "carapicho" in Brazil.

Xerotideæ.—*Xerotes longifolia*, a native of Queensland, with leaves 4—6 feet long, affords the aborigines a useful fibre, and is now largely employed for paper-making. Other species in Australia are *X. filiformis*, *X. tenuifolia*, *X. glauca*, *X. rigida*.

Juncacææ.—*Juncus maritimus* and *J. vaginatus* (Australia) are utilised for paper-making; *J. acutus* (Italy) affords a cordage fibre; *J. effusus* (Spain), a textile fibre.

Gramineæ.—The principal use of the members of this family is for paper-making. The most important are *Macrochloa* (*Stipa*) *tenacissima* and *Lygeum spartum*, both found in Spain and N. Africa, and affording the well-known "esparto" of commerce. Much of that obtained from Algiers, Tunis, and Tripoli is the produce of *S. gigantea* and *M. arenaria*. *S. Ichon* and *Chusque. Lorentziana* occur in the Argentine Republic, and *S. setacea*, *S. pubescens*, *S. micrantha* in Australia. *Andropogon involutum*, *A. glycichylum*, *A. saccharatum*, *A. Iwarancusum* (E. Indies), *A. condensatum*, (Argentine Republic), *A. tenuis*, *A. sericeus*, *A. triticeus* (S. Australia), afford useful fibre; also *A. gryllus* and *A. Ischæum* (Europe), and *Gymnostachys anceps* (New South Wales).

Saccharum Revennæ and *S. Sorghum* are of small importance. *S. munda* (India, especially Oude) is cultivated, and affords the "moong" fibre for cordage and textiles. *Arundo saccharoides* (Venezuela) furnishes material for the "sombbrero" hats; *A. ampelodesmos* (Italy) is used for cordage; it occurs in quantity in the Portofino range. *A. festicoides*, *Ampelodesmos tenax*, *Arundinaria macrosperba* (Mississippi), *Bambusa arundinaria*, *B. nigra*, *B. mitis*, *B. verticellata*, *Donax arundinaceus*, *festuca patula*, *Hydropyrum esculentum*, *Zizania aquatica*, *Zostera marina*, &c., afford fibres.

Typhaceæ.—*Typha angustifolia* and *T. latifolia*, as well as *Sparganium latifolium*, have local applications (Spain, Egypt, Tunis, and Japan).

Cyperaceæ.—*Cyperus papyrus* (Egypt) and *C. rotundus* (Japan) are much used for basket-making. In Angola, papyrus leaves are used with baobab fibre for mats, &c. Others are *Carex appressa* and *S. tereticaulis*, *Cladium radula* (Tasmania), *Lepidosperma gladiata* and *L. elatia* (Australia); *Schæenus brevifolius* (coasts of S. Australia, Victoria, and Queensland) *Hydropirium latifolium* (Japan), *Isolepis barbata* and other species (Japan and Australia), *Scirpus maritimus*, *S. lacustris*, &c.

Filices.—The root-fibres of *Pteris aquilina* (Japan) are used for cordage. In Brazil and Cuba, *Polypodium Calaguala* is utilised. In the Sandwich Islands, *Cibotium Barometz* affords the "pulu" fibre.

Coniferæ.—From the needles of *Pinus sylvestris* is made a textile fabric, in Thüringer-wald, America, England, France, Sweden, Holland, and Australia. In Japan, *Cryptomeria japonica*, *Chamaecyparis obtusa* and *Pinus densiflorus*, are utilised for the production of lint.

Araliaceæ.—*Aralia papyrifera* and *Hedera helix* yield the Chinese "rice paper."

BAST FIBRES. Such well-known members of this class as flax, hemp, jute, China grass, &c., need no mention here.

Malvaceæ.—The fibres extracted from *Abutilon venosum*, *A. amplum*, *A. auritum*, *A. molle*, *A. striatum*, *A. indicum*, &c., are utilised in Africa, Brazil, Australia, and the East Indies. The stems are cut off, sun-dried, and retted in bundles for ten days. In Algeria, *A. indicum*, is extensively cultivated. A more important genus is *Hibiscus*—*H. splendens*, *H. elatus*, *H. mutabilis*, *H. tiliaceus*, *H. zonatus*, *H. heterophyllus*, *H. syriacus*, *H. sabdariffa* (*clypeatus*), *H. cannabinus*. The fibres yielded by these plants are called, in India, "gambo," "pundi," "ambaree;" in Cuba, "majaqua;" in Angola, "ketmie," "punda;" in Queensland and New South Wales, "hollyhock fibre," "Batham hemp;" in Syria, "rose hemp;" elsewhere, "brown hemp," "roselle." It is widely believed in India that *H. cannabinus*, properly grown and retted, is superior in all respects to jute; large quantities of this fibre come into commerce as jute. In Victoria, *H. splendens* grows 9 to 21 feet high; in Japan, *H. syriacus* is cultivated and largely utilised.

In Spain, is utilised the unusually fine, strong, and white fibre of *Lavatera maritima*. The plant is perennial, and easily cultivated; it has lately been grown experimentally in Australia. *L. olbia* and *L. arborea*, both of S. America, growing best on the coast yield fine fibres by retting. *Malva rotundifolia*, *M. crispa*, and *M. sylvestris* are widely utilised; also *M. peruviana* in Peru, and *M.*

mauritiana in Italy, Portugal, Spain, &c. The fibres from *Plagianthus pulchellus* and *P. betulinus* are much esteemed in New Zealand, Tasmania, Victoria, and New South Wales. They are long, fine, and soft, and seem lately to have attracted as much attention as those from *Sida rhomboidea* and *S. retusa*, which are extracted and valued in the E. Indies, China, N. Australia, Queensland and America. In China, *S. tiliifolia* is cultivated, and its fibres are esteemed superior to hemp; in India, *S. rhomboidea* is similarly placed before jute, yet the culture of both species is much neglected. The genus *Sida* is most widely distributed in the tropics of N. Australia; in a lesser degree, in the south also. In the former locality, grow *S. corrugata*, *S. intricata*, *S. virgata*, *S. petrophila*; in the latter, *S. retusa*, *S. cordifolia*, *S. spinosa*, *S. macropoda*, and *S. rhomboidea*. Under the title "Queensland hemp," these fibres are already utilised for spinning and paper-making.

Other malvaceous plants, yielding useful fibres, are *Alcea*, *Malvastrum*, *Fugosia*, *Thespesia*, *Althæa canabina*, *Paradium elatum*, *Pueraria Thunbergiana*, *Lagunaria Patersoni* (Norfolk Island), *Echytes barriguda* (Brazil), and *Adansonia digitata*. The last-named affords a bark-fibre, which, in Angola, Loando, and Inner Africa, is employed for lines and nets, and is shipped from the Congo, to the extent of about 1,700 tons yearly, chiefly for paper-making.

Tiliaceæ.—Several members of this family produce a useful bast. *Tilia pauciflora*, *T. parviflora*, *T. vulgaris*, *T. platyfolia*, and *T. angustifolia*, are utilised in Europe, the Caucasus, and Central Asia, more particularly in E. Russia, and *T. cordata* in Japan; also *Elæocarpus cyaneus* and *E. obovatus*, in Australia. The preparation of the bast is not difficult. It is stripped from the young trees in spring, retted for several months (generally in stagnant water), washed clean, and dried. Both in Russia and Japan, it is largely applied to numerous purposes—baskets, hats, ornaments, and especially shoes—while it is elsewhere widely consumed for binding. It is estimated that 30,000,000 young linden trees (5—10 years old yearly are robbed of their bast. In the governments of Nijni Novgorod, Wiatka, Kostroma, and Minsk, the manufacture of linden-bast shoes numbers 7,000,000 pair. Besides this, about 400,000 pieces of matting are exported through Archangel, and at least $1\frac{1}{2}$ millions at the Black Sea ports and landwise, while the internal consumption much exceeds the export. In Japan, the bast is prepared much finer, and extensively manufactured into textiles. *Sparmannia africana* ("African hemp"), by retting, yields a fibre that is largely used locally; it is now introduced into Australia. *Grewia occidentalis* ("Kaffir hemp") affords a white fibre, of great strength, which is extracted by the Kaffirs of South Africa by retting, and is much used by them. The fibres of *Triumfetta appendiculata*, *T.*

glaucescens, and *T. elliptica* (Brazil and Australia), and of *Aristotelia Magni* (South Sea Islands), are also somewhat extensively used.

Sapindacæ.—The birch and alder contribute to the Russian bast industry, especially the former, some 16 millions young birch trees being deprived of their bark in a year. The bast of several species of chestnut (*Æsculus*) is similarly turned to account, large quantities being used in Brazil for caulking ships.

Sterculiacæ.—*Sterculia fætida*, *S. rupestris*, *S. Dombeya*, *S. acerifolia*, *S. ramiflora*, and *S. villosa*, indigenous to Australia, the E. Indies, America, and Natal, as well as *S. tomentosa* in Angola, afford excellent fibres. The wood of some species, e.g., *S. acerifolia* is so fibrous as to be useless as timber. *S. caribæa* (Trinidad and New Caledonia) affords a very fine fibre ("mata-gua"), which is much used; its seed-hairs are also employed.

Helicteres Isora, in the E. Indies, Japan, and Australia, affords a useful fibre ("muroor phalii"); likewise *Eriochlæna Candollii* (Brazil), *Lasiopetalum discolor*, and other species, *Melochia corchorifolia* (Australia), *Waltheria americana* (Brazil), and *Thomasia petalocalyx* (Australia and Africa). This family also includes *Hoheria populnea* (New Zealand), whose strong gauze-like bark fibre has long been utilised by the natives.

Thymelacæ.—*Guidia daphnoides*, *Daïs cotonifolia*, and *D. madagascarensis* (Africa, especially Madagascar), are rich in fibre. *Daphne cholua*, *D. cannabina*, and *D. papyrifera* are much employed in Nepal and China. *Legetta lintearia* (*Daphne lagotto*), occurring in Brazil and Jamaica, yields a mass of reticulated fibres ("lace bark"), which is converted into many fancy articles. *Daphne aureola* is utilised in Spain, where it is very common. From *Lasiophylon speciosus*, is obtained the "rameta-bast" of India. *Dirka palustris* is found in N. America. Of the genus *Pimelea*, twelve species are natives of Australia; *P. axiflora* affords the "currajong" fibre of Victoria. *Passerina Gauppii* (E. Indies) also yields good fibre.

Anonacæ.—The fibre of *Xylopia frutescens* and *X. sericea* (Brazil), whose fruits form a kind of pepper, is locally employed for cordage; it appears in commerce as "pindayba." *Anona squamosa* is utilised in Guadeloupe and Angola.

Asclepiadacæ.—Textile fibres are procured especially from *Asclepias astmatica* and *A. spinosa*; also from *Calotropis gigantea*, already noticed as yielding seed-hairs. This last is a native of India, and gives the fibre called "mudar" or "yercum." The plant is cultivated; cut down and sun-dried, the stems yield their fibre, which soon bleaches well in the dew. In the Amritsur district, also occur *C. procera* and another species. Useful fibres are likewise extracted from *Leptadinia*, *Orthanthera*, *Stephanotis*, *Beaumontia*, *Hoya*, *Periploca*, *Hemidesmos*, *Cynanchum*,

Notes on some neglected Fibres.

Vincetoxicum, and *Marsdenia* (India, Senegal, N. America, Brazil, &c.) The *Marsdenia* fibre is termed "jeteo," and is largely used.

Apocynaceae.—The fibres of this family were formerly much more widely economised than they are at present. *Apocynum venetum*, *A. sibiricum*, *A. syriacum*, *A. fatidum*, and *A. cannabinum* grow in great profusion in S. Siberia and Turkestan, also in Krim, Trans-Caucasia, on the Adriatic, in N. America, and in Panama. In Turkestan, *A. venetum* attains a gigantic stature; it occurs abundantly in the province of Semiretschi, in the lands of the Ili, on the banks of the Syr, throughout the khanate of Kokan, in the valley of the Zariadschane, and around the Ara' Sea. In the lands of the Ili, the plant covers the steppes, and its fibre, under the name of "oma," is used for nets, fishing-lines, rope, and twine, but not for textiles. In other districts, the fibre is called "kendyr," and is more carefully prepared for textiles, in spite of the competition offered by cotton. The fibre is separated from the stems by a short retting; it is very strong and elastic, easily divisible, bleaches and dyes well, and occurs in such valuable lengths as 6—12 feet. Systematic cultivation of the plant is being set on foot in Turkestan and Senegal. In N. America, the fibre, called "wild silk-hemp," is employed by the natives, but has not yet received much attention from cultivators. In Germany, *A. cannabinum* is widely distributed. Other members of the family yielding fibres are *Aspidosperma*, and *Hancornia* (Brazil), *Parsonia*, *Alyxia*, *Alstonia*, *Wrightia*, *arissa*, *Nerium* (India), *Tabernaemontana dichotoma*, *T. orientalis*, *T. pubescens* (Australia).

Urticaceae.—This family is conspicuous for the importance of its fibre-yielding members, among which are hemp and China-grass. It is estimated that from the mulberry trees (*Morus*) in the French silk districts, 15 million kilos, of fibre might be produced annually. The Japanese already utilise the fibre largely for paper-making. *Broussonetia papyrifera* ("paper-mulberry" or "kodzu") is also used for paper-making in Japan, alone or together with *Chamaecyparis obtusa* ("hinoki"), *Passerina Gaputii*, *Edgeworthia papyrifera*, *Pikrasma aianthoides*, *Lespedeza cyotobotria* ("hanzi"), *alix japonica* ("kawayanagi"), which are also converted into textiles. From several species of *Urostygma*, the best fibres, "wad," "pimpal," "kel," &c., are extracted in the E. Indies. The fibres of *Gnetum funiculare* and *Gnemon* have long been utilised by the Malays of the Sunda Island. *Holoptelea integrifolia* (E. Indies.) affords "wawla-bast." *Ficus indica* ("bar"), *F. retusa*, *F. aspera*, and *F. leucotricha*, are made use of in India. The fibres of *Planera japonica* and *Ulmus campestris* are extracted in Russia, China, and Japan.

The nettles form a very important group. The species hitherto identified are:—*Urtica* (*Bahmeria*) *nivea*, *U. (B.) tenacissima*, *U. caracasana* (Tahiti), *U. orenulata* (India), *U. (Girardinia)*

heterophylla (E. Indies), *U. argentea* (E. Indies, Sunda Islands, and Society Islands), *U. baccifera* (Cuba), *U. japonica* and *U. Thunbergiana* (Japan and the Sunda Islands), *U. alienata* (India), *U. dioica* and *U. urens* (Europe), *U. cannabina* (Caucasus, Turkmenan, Siberia, and E. Indies), *U. virolenta* (India), *U. incisa* (S. Australia and Victoria), *U. cestuans* (Tahiti), *Bahmeria caudata* (Argentine Republic), *B. goglado* (India), *B. salicifolia* (India), *B. frutescens* (Naples), *B. diversifolia* (Sunda Islands), *B. paya* (India), *B. macrostachya* (India), *B. candicans* (Algiers and India), *B. sanguinea* (Java and India), *B. palmata*, *Laportea gigas* (New South Wales and Queensland), *L. pustulata* (N. America, Cuba, and Mexico), *L. canadensis* (N. America).

Urtica (*Bahmeria*) *nivea* affords the bulk of the fibre now obtained from the nettles, and known as "China-grass," "ramie," or "rheea." The quality varies exceedingly with the methods of growth and preparation; the fibre brought from the Sunda Islands, India, Formosa, Siam, &c, is not so fine as that from the Chinese nettle-fields. *U. heterophylla* contains a very delicate, fine, and strong fibre, the plant thrives on the Neilgherries, and its cultivation has been commenced in Coimbatore. *L. pustulata* grows in the Alleghany range, and on the Mexican plateau abundantly, but as a branchy shrub; cultivated, it forms single stems, containing a fine fibre. *U. dioica* grows wild in Europe, but branchy; cultivated at 5—8 in. apart, the plants from single stems $4\frac{1}{2}$ — $7\frac{1}{2}$ ft. high. *L. gigas*, in Queensland and New South Wales, grows 70—80 ft. high on fen-lands, and gives branches 18 ft. long. The natives employ the fibre for nets, mats, &c.

The profitable extraction of fibre from nettles is possible only when they are cultivated. The beauty, length, and strength of the fibres recommend them to all interested. In N. Europe, *U. dioica*, *U. urens*, and *U. cannabina* are grown; in France, Italy, Spain, and Portugal, *U. nivea* and *U. tenacissima*. In Algeria, *U. nivea*, *B. candicans*, *B. palmata*, and *B. tenacissima* give several crops annually. In N. America, *U. nivea* and *L. Pustulata* are grown; the plantations in Louisiana and Mississippi have given three to four crops annually, an acre affording about 500 lbs. of fibre. In Australia, experiments are being made with *U. nivea* and *U. tenacissima*, the native *U. invisa* being unprofitable. In other of our colonies, the culture is being attempted, as in Jamaica, also in the Seychelles, Lagos, &c. The French colony of Cochin China produces much wild ramie, and the Government in Saigon is encouraging improvements in the culture and manipulation of the plant. Madagascar grows an abundance of nettles, and the French are endeavouring to start their cultivation in St. Mary's. Similar steps are being taken in Réunion, Senegal, Guadeloupe, and Guiana.

Spania Wrightii and *S. orientalis*, are utilised in Venezuela and Louisiana; *Paristaria debilis*, in Portugal, Angola and Australia;

P. malaisia, in Sunda Islands; *Celtis Philippinensis*, in the Philippines; *C. aspera* ("mukunoki") and *C. sinensis* ("yaoku"), in Japan; *C. tremula* in Amboyna and Australia; *Fatoua pilosa*, in S. Australia; *Leucoconide candidissima* and *L. alba*, in Java. *Pipturus velutinus* (New Caledonia) affords a very beautiful fibre for fancy textiles; *P. argenteus* ("konganga" or "Queensland grass-cloth plant") occurs in N. America, the E. Indies, the Sunda Islands, N. Australia, and Queensland.

The fibre yielded by the hop (*Humulus Lupulus*) seems likely to receive some attention, especially in America. It is reckoned that the hop-gardens of America occupy some 24,000 hectares, and that the quantity of fibre contained in the plants is equal to two-thirds the yield of hops, or say 332 kilos an acre, giving a total of 16½ million kilos. At this rate, Germany, Great Britain, and Austro-Hungary might utilise about 46½ million kilos of hop fibre.

Leguminosæ.—The European genera, *Genista*, *Spartium*, *Ononis*, and *Cytisus* were formerly much more commonly employed than they now are. One of the most important is *Spartium junceum* ("Spanish broom"), and the two other species, *S. monospermum* and *S. multiflorum*. These occurs in France, Spain, Portugal, Italy, Greece, and Turkey; they are found in great abundance in the Appennines and the mountains of Calabria, and in Tuscany, where the industry in "tela ginestrina" is becoming important. In Central France, the peasants still employ *Spartium* fibre for textiles.

Melilotus and *Astragalus* are other European fibre-plants. *A. confertus* is largely utilised in Thibet. *Lupinus albus* is also rich in fibre.

Dolichos trilobus is a most important fibre-plant in China, textiles made from it being termed "grass-cloth," like those from nettle-fibre. *Dolichos* or *Pachyrrhizus* fibre has been utilised in China from the earliest times; and in Shantung, the manufacture was so extensive that the tributes were paid in textiles made from it. *Muncana brasiliensis* seems to afford an equally valuable fibre. From *Dolichos umbellatus*, widely grown in Japan, no fibre is separated; but *D. tuberosus* and *D. bulbosus* (in China) are turned to account. *Pachyrrhizus montana* (Venezuela and New Caledonia) yields a moderately strong fibre. A most important fibre-yielding plant of Japan is *Wisteria chinensis*; the bast is very largely employed for baskets, plaits, and fine hats, also for lace and clothing. Another plant extensively applied to the same purpose is *Pueraria Thunbergiana*, well-known for its starch ("kudzu").

Orotalaria juncea and *O. tenuifolia* have long been classed among India fibre-plants. In Australia, *O. dissitiflora*, *O. himifolia*, and *O. crispata* occur wild; *O. juncea* is cultivated in Queensland.

Bauhinia racemosa, *B. scandens*, and *B. Vahlis* are utilised in

the E. Indies; *B. Hookeri* grows wild in S. Australia. The fibres of these species are coarse, and used only for cordage. *B. reticulata*, *B. parviflora*, *B. rufescens*, &c., are employed in Senegal and Angola; *B. splendens* ("bepico de cadena"), in Venezuela; and *B. coccinea*, in Cochin China.

Other leguminous plants affording fibre of economic value are:—*Sesbania grandiflora*, *S. aculeata*, and *S. ægyptiaca*, natives of the Indies, Java, and Australia; *Æschynomene Cannabina* gives the "dunsha hemp;" *Æ. paludosa (aspera)* is a large ingredient of "rice paper;" *Butea frondosa* (Moorsheadabad) gives "pulas hemp;" *B. superba* (India), "dhak hemp;" and *B. parviflora*, "palash fibre."

Here and there use is made of the fibres of *Erythrina*, *Hedysarum*, *Cassia*, *Agati*, *Vigna*, *Alylosia*, &c.

The bast-fibres of *Acacia alba* and *A. catechu* are used for nets; *Mimosa scandens* gives the "gogo" fibre of the Philippines; and *M. dealbata* is utilised in Réunion.

Euphorbiaceæ.—*Euphorbia Royleana* is turned to account in the E. Indies, and *E. australis* in Queensland. *Jatropha gossypifolia* (Venezuela), and *Securidaca longipedunculata* (Zambesi), afford flax-like fibres; *Kydia calycina* (Jamaica), a good strong fibre; *Tropeæolum majus* (Ireland), a flax-like fibre and *Rourea santaloides* (Ceylon), a coarse fibre.

Salicaceæ.—Fibres for nets are afforded by *Salix cordata* on the Peel's river (N. America), and by *S. arctica* on the Mackenzie. *S. japonica* occurs in Japan.

Myrtaceæ.—An important genus is *Melaleuca*; *M. Preissiana* (not *squarrosa*) has a layer of soft fibre outside its strong solid timber, much used by the Australian aborigines. *Eucalyptus obliqua (nervosa)* has a very fibrous bark, applied to many purposes in Tasmania, Victoria, and S. Australia; *E. fissilis* is less fibrous. In Brazil, *Ouratari tauari* affords fibre; further, *Bertholetia excelsa*, *Lecythis lanceolata*, *L. Pisonis*, *L. coriacea*, and *L. angustifolia*, yield fibre for ropes and for caulking ships. *Careya arborea* (Australia and the E. Indies) gives the fibre called "kumbi" and "phouleta."

Artocarpææ.—*Artocarpus integrifolia* (New Zealand, Polynesia, and New Guinea), as well as *A. incisa*, affords a useful fibre, much employed by the natives under the name of "ti." In Cuba, occurs *Lonchocarpus sericeus* ("guama," "guacacao"). *Antiaris saccidora* affords, in India, the so-called "jasund;" in Venezuela, it is termed "dog-tree," and furnishes the "marima" shirts of the natives. *Trophis aspera* yields strong fibres, as also does *Lepuranda saccidora*.

Compositæ.—In this family, are *Bidens tripartita* ("water-hemp"), and *B. bipinnata*; *Eupatorium cannabinum*, *Plurmica vulgaris* ("wild hemp"), and *Andromachia igniaria* from Quito;

Stephanotis, *Gandlobus*, *Fischeria* (Brazil); *Roupelia grata*, *Iconocarpus paniculus*, &c.

Byttneriaceæ—The fibre of *Theobroma Cacao* is well known, but little used. *Abronia angusta* (India and Assam) is the source of the "oolut" fibre. Others are *Dombeya umbellata*, *Microlaena spectabilis* (much utilised in Madagascar), *Aletris nemorosa* (Pondicherry), *Cascarilla alba* (Bahamas), and *Guauma ulmifolia* (S. America). (*Journal of the Society of Arts.*)

TREES YIELDING INDIA-RUBBER.

India-rubber or caoutchouc, is afforded by a considerable number of trees and shrubs, chiefly if not entirely members of the families *Euphorbiaceæ*, *Artocarpaceæ* and *Apocynææ*. It is to be distinguished from gutta-percha, which is a product of trees belonging to the family *Sapotaceæ*.

In its natural condition in the plant caoutchouc is a milk-like fluid, and the channels in which it occurs occupy a definite position in the structures composing the stem. It is of the highest practical importance to bear in mind that the "milk-vessels" occur wholly in the bark, externally to the cambium layer or vitally active part of the stem where growth goes on. There are none in the wood, nor in the outer corky, papery, or green layers, but only in the inner part of the bark, and either adjacent to or in its bast or liber-tissue.

The kinds of rubber-trees at present exciting interest in Ceylon are:—

1. Cearà Rubber-tree (*Manihot Glaziovii*, Müll. arg.).
2. Para Rubber-tree (*Hevea Brasiliensis*, Müll. arg.).
3. Central American Rubber-tree (*Castilloa elastica*, Cerv.)

These three are all natives of tropical America, and are in cultivation at both Peradeniya and Henaratgoda gardens. The two former are North Brazilian Euphorbiaceous trees; the last is Artocarpaceous and extends over a wide area—from Mexico as far south as Guayaquil on the west coast of South America.

None of these species have been yet subjected to systematic cultivation out of a botanic garden, but the efforts of the Indian and Home Governments, extended over many years, have at length brought us to the eve of that long-desired result. It will therefore be well to make public what is known of the nature of these plants, of their surroundings in their native localities, and of the methods by which the product is obtained and prepared. Our information is unfortunately but scanty, being mainly derived from the somewhat meagre accounts of the few travellers who have had the opportunity of seeing the trees wild, and especially of the veteran collector, Mr. B. Cross, employed by

India Rubber.

the Indian Government, by whose energy and perseverance they were brought to England.

I.—Ceara Rubber (*Manihot Glaziovii*).—1. *Locality, Soil, and Climate*.—Ceara is a coast town of Brazil in lat. 4° S., and the flat country which runs back to the hills is described by Mr. Cross as manifestly possessing “a very dry arid climate for a considerable part of the year. This is evident from the fact that mandioca and other crops required to be irrigated. The rainy season is said to begin in November and end in May or June; torrents of rain are then reported to fall for several days in succession, after which the weather moderates for a brief space. According to some statements there are occasional years in which hardly any rain falls. The assertion concurs with the aspect presented by the country in general. The daily temperature on board the ship ranged from 82 degs. to 85 degs. F., but inland it is often, probably, 90 degs. The localities traversed by me nowhere seemed to be elevated more than 200 feet above the sea.” At Pacatuba, about forty miles from Ceara, the actual place where the specimens were obtained, “the general forest was tolerably high, but the sparse small foliage did not afford much shade from the fierce rays of the sun. The soil was in places a sort of soft sandstone or gravel, which was bound up in the most extraordinary manner. Neither grass nor weeds grew among this underwood, and there was an entire absence of ferns, mosses, and other plants.” In another place, somewhat further from the coast, the traveller shortly after entering the bush-like forest “came on a large tract of land covered by immense masses of grey granite, some of which might be fifty tons or more in weight. These had been broken where they lay, and were the result of a volcanic explosion. Rounded masses of the same rock also cropped out in many places. . . . Many good sized rubber-trees were growing in the spaces between these granite masses. . . . The situation was very dry, but no doubt some seedlings had sprung up which, owing to numerous thickets of shrubs were not perceived.”

2. *Propagation and Planting*.—Mr. Cross's directions are as follows :—“Seeds are early produced, if the tree is not shaded. They should be buried in brown sand, kept pretty moist until there are indications of growth, when they may be planted out permanently. In some situations where the ground is rough and strong they might be sown broadcast. Meantime I would suggest the formation of plantations by cuttings, which will take root as easily as a willow. These should be taken from the points of strong shoots and may be one foot in length. In planting, each cutting may be put down in the soil to a depth of six inches. If scarce, the entire shoot may be cut into pieces, each possessing a bud, all of which will grow, if covered with half-

India Rubber.

an-inch or so of soil. On loose sandy soils, or exhausted coffee land, plantations may be formed at little expense. Hard, dry gravelly wastes, if found to support any kind of bush, are also suitable sites. Holes might be made in strong land with an iron jumper and a stout cutting put into each and filled with pebbles. On bare or thinly covered portions of rock the cuttings might be laid down flat, and a little heap of stones or any kind of *débris*, about the size of a molehill, piled over each, care being taken that the extreme point of each cutting with a bud is left uncovered. I do not advocate planting in an entirely barren desert, but wherever there is any sort of stunted tree or scrub vegetation, with an occasional sprinkling from a monsoon shower, the tree is likely to prosper."

Experience of the plant in the botanic garden here has proved the general accuracy of the above remarks. There can be no doubt of the hardiness of the species, its readiness of culture, and adaptability to circumstances. It grows equally readily from seed or from cuttings, and though a native of a tropical sea-level, thrives well here in Ceylon up to at least a level of 3,000 feet, and on the most barren soils. It has succeeded equally in Calcutta and Madras, but the wet season appears to have killed it at Singapore. It would seem especially adapted for the dry and barren districts of our Eastern and Northern Provinces, or in the higher districts, but it would not be wise to risk it in localities where the temperature is liable to fall below 60 degs. F.

Germination of Seed.—The seed coat is of remarkable thickness and very hard, and the natural process of germination occupies a long period—it is said more than a year. All that is necessary to hasten this, if desired, is to assist the seed coat in splitting. This is best effected by holding the seed firmly, and rasping off with a file both edges at the radicular end.* It is best not to file off the actual end, as it may thus easily happen that the radicle of the embryo may be injured. After this treatment, properly performed, the young plant appears above ground in two or three weeks. The seedlings require no particular attention. They grow rapidly and may be finally planted out at distances of twenty feet. A peculiarity which they share with their close relative the mandioc is the possession of large tubers on the spreading roots. The trees at Peradeniya, from which seed has been distributed to Burmah, India, Jamaica, etc., flowered at the age of eighteen months, and at the present time (at 2½ years) the larger ones form branching trees about 25 feet or 30 feet high, with a stem 1 foot 9 inches in circumference at a yard from the base, and a smooth, silvery birch-like

* This end is to be recognised externally by possessing at its side a flat two-lobed appendage technically known as the Carbuncle.

bark readily peeling off; being ~~about~~ half the size of those which Mr. Cross describes, and which may be assumed to have been fully grown.

3.—*System of collecting the Rubber.*—I quote again from Mr. Cross's report:—"This is an operation of a very simple description. On commencing to work, the collector takes with him a stout knife and a handful of twigs to serve as a broom. Arriving at a tree, any loose stones or dust are swept from the ground around the base, and some large leaves are laid down to receive the droppings of milk which trickle down. Some do not go to the trouble of sweeping the ground or laying down leaves, for which reason the milk adheres to sand, dust, decayed leaves, and other impurities. The outer surface of the bark of the trunk is pared or sliced off to a height of four or five feet. The milk then exudes and runs down in many tortuous courses, some of it ultimately falling on the ground. After several days the juice becomes dry and solid, and is then pulled off in strings and rolled up in balls or put into bags in loose masses. Only a thin paring should be taken off, just deep enough to reach the milk vessels, but this is not always attended to. Nearly every tree has been cut through the bark, and a slice taken off the wood. Decay then proceeds rapidly, and many of the trunks are hollow. In this condition the trees must yield far less milk and many no doubt are broken over by the wind, or wither away. Collecting is carried on during the dry season only, when rain seldom falls."

Mr. Cross says nothing as to the age of the trees so operated upon; probably the collectors treat all indiscriminately. In the sequel of his report, however, he incidentally remarks that Ceara rubber may be tapped on attaining "a diameter of four to five inches," which is the case here in Ceylon after about two years growth. But unless there were a very large number of trees in an extensive plantation, this would certainly be labour thrown away. The tree, however, comes so early to maturity, as shewn by the production of seed, that it is improbable that it attains any very great size. The process above described must be, if thoroughly done, almost exhaustive of the milk, but in the case of a small stem it would be a work of some care and time to so conduct it as to avoid cutting into the wood, and probably some of the methods afterwards described will be preferred. But these are practical difficulties which it may be safely assumed the ingenuity of our planters will quickly master.

II.—*Para Rubber.*—(*Hevea brasiliensis*).—1. *Locality, Soil, and Climate.*—The town of Para occupies a position near the mouth of one of the vast embouchures of the Amazons in about south latitude, 1° , but the district of the same name extends over a vast forest region to the south and west, throughout which and the enormous forest of Central and Northern Brazil

this and allied species are abundantly found. The climate has been often described and is remarkable for its uniformity of temperature, usually not exceeding 87 degs. F. at midday or below 74 degs. at night. The greatest heat recorded is 95 degs., and the mean for the year is 81 degs.

The rainfall occurs principally during the months from January to June, the maximum being in April when it reaches 15 inches. For the remaining six months of the year very little falls, but there are fine days in the wet season and occasional showers in the dry. The whole country is covered with dense moist forests, and the soil near the numerous and gigantic rivers is deep, heavy, and very fertile. During the wet season much of the low-lying country near the Amazon's mouth is flooded. In the *Gapos* near Para, visited by Mr. Cross, he found a flat district only three or four feet above the highest tides and completely intersected with watercourses at low tide, filled with a soft rich mud. The forest here, in which caoutchouc collecting was vigorously carried on, was 80 or 100 feet high, and very damp and unhealthy, the soil full of moisture and very rich and fertile. The young plants, however, were not often observed to grow actually within the reach of the tides, but it is evident that they must frequently be subject to be partially covered with water.

2. *Propagation and Planting*.—This valuable species as yet has been propagated from cuttings only. No fresh seeds were brought to this country, but to judge from dry ones in the herbarium of the British Museum, London, they are considerably larger than those of the Ceara rubber. Our largest trees at Henaratgoda, three years old, are thirty feet in height with a slender stem scarcely branched, and about twelve inches in circumference near the base; but neither there nor in Peradeniya have they shewn any symptoms of flowering.

Cuttings may be taken from the green lateral twigs as soon as they begin to harden; they strike readily in rich firm land. Mr. Cross observes that "for planting on inundated lands the period of high flood should be preferred: Cuttings of greater length would be required in this case, the lower ends of which should be sliced off in the form of a wedge. The workman could take a bundle of these, and wading into the water would plant at proper distances, but perfectly upright, taking care to push each cutting down deep enough in the soft muddy bottom, so that not more than three or four inches is above the surface of the water. The same rule would be applicable when planting in sludge or soft marsh land. The crowns of the cuttings must not, if possible, be put under water, as the young growths springing therefrom might rot. Seeds will not be found very applicable for planting in watery places or deep mud deposits.

Some would come up, but a good many would mould and decay. In the varied course of circumstances and conditions, slight changes and modifications in the methods of working will no doubt suggest themselves. . . . It should be planted in places where nothing else could be profitably cultivated, such as frequently inundated river margins, marsh land, and mud deposits." It would not be desirable to form a plantation in any locality where the temperature at any time falls to 60 degs. F.

The tree when fully grown does not exceed a height of about sixty feet, and the largest trunk measured by Mr. Cross was six feet ten inches in circumference at a yard from the ground. From the upright habit of the tree it will not be necessary to plant at any great distance apart.

Over 500 plants have been sent from Ceylon to Burmah and some to the Madras Presidency. An attempt to grow the tree in Assam failed.

3. *Collection of the Rubber.*—Several accounts have been given of this, the fullest and most recent being that of Mr. Cross, who saw in practice the methods employed in the neighbourhood of Para. His description is as follows :—

"The collectors begin to work immediately at daybreak, or as soon as they can see to move about among the trees. They say the milk flows more freely and in greater quantity at early morn. I do not attach much importance to this statement, but I have recorded it. Another and more probable reason is, that as rain often falls about two or three o'clock in the afternoon, the tapping must be done early, as in the event of a shower the milk would be spattered about and lost. The collector, first of all, at the beginning of the dry season, goes round and lays down at the base of each tree a certain number of small cups of burnt clay. At the lesser trees only three or four are put, but at the larger ones from eight to twelve are deposited. The footpaths leading from tree to tree are likewise cleared of sapling growths, and the bridges over the *gapos* [natural ditches] formed at each place by the trunk of a tree are, where necessary, replaced. On proceeding to his work the collector takes with him a small axe for tapping, and a wicker basket containing a good-sized ball of well-wrought clay. He usually has likewise a bag for the waste droppings of rubber, and for what may adhere to the bottoms of the cups. These promiscuous gatherings are termed *sernamby*, and from the "Negro head" of the English market. The cups as already stated, are of burnt clay, and are sometimes round, but more frequently flat or slightly concave on one side, so as to stick easily when with a small portion of clay they are pressed against the trunk of the tree. The contents of fifteen cups make one English imperial pint. Arriving at a tree, the collectors take the axe in his right hand, and, striking in an upward

direction as high as he can reach, makes a deep upward sloping cut across the trunk, which always goes through the bark and penetrates an inch or more into the wood. The cut is an inch in breadth. Frequently a small portion of bark breaks off from the upper side, and occasionally a thin splinter of wood is also raised. Quickly stooping down he takes a cup, and pasting on a small quantity of clay on the flat side, presses it to the trunk close beneath the cut. By this time the milk, which is of dazzling whiteness, is beginning to exude, so that if requisite he so smooths the clay that it may trickle direct into the cup. At a distance of four or five inches, but at the same height another cup is luted on, and so the process is continued until a row of cups encircle the tree at a height of about six feet from the ground. Tree after tree is treated in like manner, until the tapping required for the day is finished. This work should be concluded by nine or ten o'clock in the morning, because the milk continues to exude slowly from the cuts for three hours or perhaps longer. I may state that there is a great difference among collectors in the performance of these duties. Some take care to get good clay previously, and incorporate it well, so that a very small portion is needed to lute the cups to the trunks; they also work with neatness and intelligence, and invariably collect a good quantity of milk. Others, again, do not take the trouble to prepare clay beforehand, but merely scrape up a handful when they require it at the side of a *gapo*, which is often of little consistence, so that a large quantity is required to fasten the cups. This class of collectors have often many fragments of clay or other impurities in their milk, the result of not following a proper method of working. The quantity of milk that flows from each cut varies, but if the tree is large and has not been much tapped, the majority of the cups will be more than half full, and occasionally a few may be filled to the brim. But if the tree is much gnarled from tapping, whether it grows in the rich sludge of the *gapo* or dry land, many of the cups will be found to contain only about a tablespoonful of milk, and sometimes hardly that. On the following morning the operation is performed in the same way, only that the cuts or gashes, beneath which the cups are placed, are made from six to eight inches lower down the trunks than those of the previous day. Thus, each day brings the cups gradually lower until the ground is reached. The collector then begins as high as he can reach, and descends as before, taking care, however, to make his cuts in separate places from those previously made. If the yield of milk from a tree is great, two rows of cups are put on at once, the one as high as can be reached, and the other at the surface of the ground, and in the course of working, the upper row descending daily six or eight inches, while the lower one ascends the same distance, both rows in a few days come to-

gether. When the produce of milk diminishes in long wrought trees, two or three cups are put on various parts of the trunk, where the bark is thickest. Although many of the trees of this class are large, the quantity of milk obtained is surprisingly little. This state of things is not the result of over-tapping, as some have stated. Indeed, I do not believe it is possible to over-tap a tree if, in the operation, the wood is not left bare or injured. But at every stroke the collector's axe enters the wood and the energies of the tree are required in forming new layers to cover those numerous wounds. The best milk-yielding tree I examined had the marks of twelve rows of cups which had already been put on this season. The rows were only six inches apart, and in each row there were six cups, so that the total number of wood cuts within the space of three months amounted to seventy-two. It grew close to a *gapo* only eight inches above high-tide mark, and being a vigorous tree the cups were usually well filled, but with two years or so of such treatment the tree would probably be permanently injured. It has been supposed that the quality of the milk is better in the dry season than during the rains. Such is the case with some vegetable products, but as regards india-rubber there ought not, I think, to be any appreciable difference. In the rainy season the milk probably contains a greater proportion of water, but, on the other hand, I am of opinion, that then a larger quantity of milk flows from the tree. No doubt the dry season is the most suitable for caoutchouc collecting, although, wherever a plantation is formed with preparing house, convenient tapping may certainly be always carried on when the weather is fine. . . . There are two other methods adopted in tapping, which are chiefly confined to the upper Amazon and tributaries. Both are exactly on the same principle, the materials used being only a little different. The loose outside bark of the tree is cleaned off to a height of about three feet. Beneath, a gutter or raised border of clay is pasted or luted to the trunk, enclosing one-half of the entire circumference. Cuts are thickly made in the bark flows down to the gutter, whence it is conveyed to fall into a calabash conveniently placed. The other mode is by winding round the trunk the stout flexible stem of a climber, and claying it round securely so that no milk may escape between the trunk and the climber. These plants are not extensively adopted, and can only be successfully put in practice where the trees have not been previously tapped. There is always a great deal of "negrohead," the result of the distance the milk has to run, and of the large quantity of clay employed in the process.

4. *Collection of the Milk.*—"Going from tree to tree at a sort of running pace the collector empties the contents of the cups into a large calabash, which he carries in his hand. As he pours the milk out of each cup he draws his thumb or forefinger

over the bottom to clean out some which otherwise would adhere. Indeed, a small quantity does remain, which is afterwards pulled off and classed as *seruamby*. The cups on being emptied are laid in a little heap at the base of each tree, to be ready for the following morning. The trees occur at various distances from 10 to 100 yards apart, and as I travelled over the intricate network of muddy footpaths, I continually felt perplexed and surprised that the natives have not yet seen the advantages that would be derived by forming plantations, whereby more than twice the quantity of caoutchouc might be collected in one-fourth the time, and at far less cost and labour."

The trees are tapped if they have a circumference of eighteen or twenty four inches, and the rough process above described is carried on for many years, until the constant and extensive injury to the young wood causes their death, for some years previous to which event they almost cease to yield milk and are practically abandoned.

It will be advisable, in order to avoid this injury, to employ an instrument for cutting so shaped and guarded that it shall not be able to penetrate beneath the inner bark. With this precaution it will probably be found unnecessary to rest the trees as has been recommended by some; but actual experience alone can decide on the method of tapping which will secure the greatest yield with the least damage to the trees' general vitality.

III.—Central American Rubber-Tree.—(*Castilloa elastica*).—

1. *Locality, Soil, and Climate*.—The very extensive geographical range of this tree shows it capable of existing under considerable varied climatic conditions. The forests in which it grows are usually at or near sea-level, but it has been observed at an elevation of 1,500 feet on the Pacific Coast. The soil varies, but the plant avoids marshy or boggy land, appearing to prefer warm deep loam or sandy clay and especially affecting the margins of small running streams where it grows in little groups. A dry or a rainy climate seems equally suitable, but a high and equable temperature, which does not sink below 60° F. at any time, is essential.

2. *Propagation and Growth*.—This is a very much larger tree than those above described, being, when fully grown, of the imposing height of 160 to 180 feet, with a stem of 12 to 14 feet in circumference. It grows very rapidly. At Henaratgoda at two years of age it was 23 feet in height. The bark is thick, and the wood soft and readily decaying. We received but a few plants of this species in Ceylon, and have had little experience in its management. No flowers have been yet produced, and Dr. Thwaites did not find cuttings of the ordinary kind to succeed well. We are now, however, endeavouring to propagate at Peradeniya by various other methods.

Mr. Cross has the following remarks:—"Trees in good situations will produce seeds early, but these will require to be planted without delay, as drying destroys their vitality." The tree is stated to flower in January, and the fruit to be ripe in April. "Stout branches, cut into pieces, each possessing a bud and covered lightly with soil, will generally be found to grow. Strong cuttings a foot in length and furnished with buds, when planted in the usual way, will become strong, plants sooner. However the propagation of this tree will not be found so easy as the *Cereia* rubber. In the planting out of young plants, the petiole or leaf-stalk of the lowest or oldest leaf should be buried in the soil. By following this simple rule the plant commences to grow at once, its growth is vigorous, and the trunk symmetrical. But if at the period of planting there is much bare stem above ground, then growth is usually slow, the plant remains 'leggy' for some time afterwards and never makes a good tree." The plant has a curious habit of dropping its young branches, which disarticulate by a regular joint, like deciduous leaves, and leave a clean scar on the surface of the stem. From what has been said above as to its native sites, it would seem that our south-western coast would present many favourable localities for this valuable tree.

3. *Collection of the Rubber.*—Milk is abundant and flows readily, but it is of a somewhat more watery consistence than that of the *Para* rubber.

In consequence of the large size of the trees it is the practice of the collectors in Panama and other parts to cut them down. A groove is first cut round the base of the trunk and the milk received into large leaves. "The tree is then felled, and rings or channels are cut out around the prostrate trunk at about twelve or fourteen inches apart," and the rubber allowed to run into leaves or vessels. In Nicaragua the trees are tapped with sharp axes in various ways, and the trees so much injured that the process is performed at intervals of three years. The milk is received into iron pails. It does not appear that this species is tapped until it has a diameter of sixteen or eighteen inches, which Mr. Cross thinks might be attained in six years.

In conclusion, a few words may be said about the preparation required to fit caoutchouc for the market. It is clear that mere exposure to the air is sufficient in some cases to affect the coagulation of the milk into a solid mass. This is all the preparation apparently that the *Cereia* rubber receives, which comes into the market in bales consisting of the rolled up strings pulled off the tree. But it seems that a decomposition is liable to occur in the milk if exposed in any quantity, and it is usually desirable to reduce it to a solid mass as quickly as possible. For this purpose the cautious application of dry heat

is the best; the best Para rubber is prepared by being poured over a flat paddle-shaped mould, which is held in the thick hot smoke from burning wood and palm-nuts till it solidifies, then slit down one side, the mould taken out and the "biscuit" hung up to dry. In several parts of Central America coalescence is effected by the addition to the milk of the juice of certain plants (especially of *Calonyction speciosum*, which is common Convolvulus here in Ceylon). This causes the separation of the caoutchouc, which floats in the liquid like a mass of soft cheese, and has to be pressed and rolled to get rid of the fluid still remaining in its substance.

Probably carefully conducted evaporation in shallow pans by artificially regulated heat would be found an effective method.

The purity of the prepared rubber being a matter of first importance, all pieces of bark and earth should be removed by passing the milk through sieves. Small pieces or thin sheets of caoutchouc are preferred to large masses in the market from the facility of estimating the purity of the article.

Absolute dryness of the rubber is also a point requiring the greatest attention and may require hydraulic pressure for its thorough attainment.

As much as 129,163 cwts. of caoutchouc were imported into England in 1874, of which 70,866 cwts. were American and obtained from the plants here under consideration. The value of this latter was £1,007,413. The demand for the best sorts is constantly increasing. On the relative market values of the various kinds of India-rubber, reference may be made to the excellent "Report on the Caoutchouc of Commerce" by Mr. J. Collins, and printed for the Indian Government in 1872, to which I am indebted for some of the above information, and to a paper by Mr. C. R. Markham in the *Journal of the Society of Arts* for April 7th, 1876.

I may be permitted to add that it is gratifying to reflect on the prominent share which the Royal Botanic Garden at Peradeniya, under the care of my distinguished predecessor, Dr. Thwaites (as detailed in his Reports from 1875-1878), has taken in the acclimatization of these valuable trees of the western hemisphere in Burmah and India; where, as well as in Ceylon, it may be confidently expected that they will become a valuable source of revenue.—*Henry Trimen, Director Royal Botanic Gardens, Peradeniya.*

INTRODUCTION OF CUZCO MAIZE AND QUINUA INTO BRITISH INDIA.

THE Cuzco maize and the *quinua* of the lofty *punas* of the Andes are two cereals which are most valuable in their native land, and I, therefore, thought that their cultivation might usefully be introduced into British India. Cuzco maize is one great result of Ynca agriculture, one lasting proof of the civilisation of ancient Peru. Growing in the lofty valleys of the Sierra, it should find a new home on the lower hills of the Western Himálaya and on the Nilgiris. *Quinua* ripens in the highest inhabited parts of the Andes, and would flourish at similar elevations in the Himálayas.

Maize, as a cereal supplying millions of people with food, is one of the most useful gifts which the Old World received from the New. But the maize of Cuzco surpasses all other kinds in its yield and its excellence.

The earliest notice of this magnificent corn is from the Ynca Garcilasso de la Vega, who was born at Cuzco and brought up upon the Cuzco maize, and who published his account of it in 1609. He says that what the Mexicans and people of the Antilles call *maiz*, the Peruvians know as *sara*. He adds that there are two kinds of *sara*. One is hard and called *muruchu*,* and this had been introduced into Spain. The other, called *copia*, is tender and highly esteemed. The Peruvians made different kinds of bread and cake from the maize. The sacrificial bread was called *canca*, the festive bread *huminta*, ordinary bread *thanta*. The women ground the corn on broad slabs with a half-moon-shaped stone, working it up and down from one end to the other, and gathering it in, from time to time, with their hands. They also made fritters called *api*, boiled puddings called *muti*, toasted grains called *camcha*, and cakes. They made a fermented liquor from the flour called *acca* (now *chicha*), and a strong spirit called *sora* and *vinapu*, as well as vinegar. A good sugar was obtained from the stalk, the stalks and leaves were used as food for cattle, while the leaves of the cobs were in request for rubbing and smoothing stones for sculptors. The Ynca Garcilasso tells us that he saw all this with his own eyes, and was sustained and nourished on this *sara* until his nineteenth year.†

The Jesuit Acosta, who was in Peru from 1570 to 1586, speaks in admiration of Peruvian maize. He says it grows on stalks, each one producing one or two cobs, and that on some cobs he had counted 700 grains. It must be planted by hand, one by one and not very close together, and it is not uncommon to gather 300 bushels for 1 bushel sown, while the green leaves and stalks are used for food for cattle and mules.

The Cuzco maize is so called from being cultivated in the warm valleys in the neighbourhood of the ancient capitals of the Yncas, but two to three thousand feet below the site of the old city.

* *Murucha* is hard in Quichua. Acosta also mentions the two kinds of maize, one great and very nourishing, the other small and dry, called *morocái*, *Nat. Hist.* lib. iv.

Its grand proportions are due to the careful agriculture of the Yncas during many centuries. The stalks grow to a height of 15 feet, and the grains are four or five times the size of ordinary maize grains. The grains were white (*colla-sara*), red and yellow (*cuma-sara*), yellow (*para-sara*), red (*misca-sara*), purple (*mgatay-sara*); and there were double cobs of immense size (*sara-mama*), which were looked upon as sacred.

The year of the Yncas was regulated with reference to maize cultivation. In June the people were occupied with the irrigation channels. Then came the sowing, the ripening, and the harvesting, each with its solemn festivals. In the month called *Ayrihuay* (April), they reaped and harvested the crops, singing a chant called *yaravi*; and the Ynca himself, with his nobles, assisted in reaping the crop on the *Colcampata*, beneath the fortress of Cuzco. These wise sovereigns held the science of agriculture in high honour.

Cuzco maize was and still is cultivated, in its greatest glory, in the lovely valley of Yucay, through which flows the river Vilcamayu. It should be grown at heights from 8000 to 3000 feet above the sea. The Yucay valley is bounded on the east by rugged escarpments of bare rock, and lofty snowy peaks of the Andes, at the feet of which are the graceful *andenés* or terraced gardens. On the west is a lower but still lofty ascent, so that the valley is well sheltered and is gay with gardens, clumps of trees, and bright green fields. The climate is like that of Italy, or of Nîmes in the south of France. Here the Yncas constructed those marvellous hanging gardens which bear testimony to the skill and taste of the designers, and where the Cuzco maize was gradually brought to perfection. The terraces are wider at the edges of the level ground, and as they ascend the mountain sides they become narrower until the topmost terrace, some 1000 feet above the valley, is scarcely two feet broad. The terrace walls are of rough stones, slightly inclining inwards, and varying in height, according to the slope of the mountain, from 3 to 15 feet. An *azequia* or artificial aqueduct, starting from the verge of the snow, is conducted through the *andenés*, whence water is led along each terrace. The terraces were filled with rich soil, from which every stone was removed, and here grew the noblest of all the varieties of Cuzco maize, the *yurac-sara* or white maize of Yucay. The palace of the Yncas, high up on one of the loftier terraces, was surrounded by the glorious maize of Yucay, and had a view from its halls, quite unequalled for combined loveliness and grandeur.

I determined that this historical cereal should be introduced from that beautiful valley of the Andes, into those of the Western Himalayas. I obtained supplies of the Cuzco maize, in several instalments, through the kindness of Messrs. Antony Gibbs & Co., the first arriving in the end of 1874; and they were duly

forwarded to the Government of India. Suitable sites would be found in the analogous valleys of the Western Himalayas, and perhaps the Nilgiris, at a height of 8000 to 4000 feet above the sea. Cuzco maize would not succeed on the plains of India, or on the Eastern Himalayas, where the rainfall is too great. So the seeds were distributed for trial on the plains of India, and in the Eastern Himalayas; and elaborate reports were written on their failure.

Fortunately the Agri-Horticultural Society of India also sent seeds, in October 1875, to the Punjab for trial in the Western Himalayas, and Mr. Halsey of Mahdopur reported that the maize grew to a height of 15 feet, and that several cobs arrived at full maturity. Colonel Chamberlain, at Ranikhet, sowed 150 seeds at a height of 5950 feet above the sea, and they all germinated and grew to fine healthy plants 10 to 12 feet high. Of these, 118 bore exceedingly fine well-formed cobs, and only 32 failed to bear seeds. Colonel Chamberlain added that he never tasted anything better than the Cuzco maize. Lieutenant Pogson of Simla also raised plants from 12 to 15 feet high, and one grain weighed as much as five grains of the ordinary Indian corn, each stalk yielding four cobs. Four cobs of Cuzco maize were equal to 20 of common Indian corn. The stalk was found to be exceedingly rich in sweet juice. [See full reports published in Journal A. and H. Society of India, vol. v. page 80.]

The Baboo Milambar Muskerjee, Judge of the Chief Court of Kashmir, made some molasses from stalks of Cuzco maize in 1877, and he conceived so high an idea of its value as a sugar producer that, on August 9th, 1877, his Highness the Maharaja of Kashmir applied for 20 *máns* of seeds for trial. This quantity was accordingly supplied to him.

In a subsequent report Colonel Chamberlain said that the Cuzco maize was incomparably the finest variety he had ever seen, and that for table purposes there was nothing known to him equal to it. He added that it could be used as a most excellent and nutritious food for cattle. In 1877 he was very successful, and was able to send 3000 acclimatised seeds of Cuzco maize to the Agri-Horticultural Society of India. The Financial Commissioner of the Punjab, after these trials, came to the conclusion that Cuzco maize would grow well in the hill districts, and that it was recommended by a double quality, producing both grain and sugar. He considered that it would be desirable to introduce it in the outer hills of the Punjab, and applied for a large quantity of fresh seeds.

The next year Colonel Chamberlain sowed a quarter of an acre with 400 seeds, which produced 38,000 grains in magnificent cobs, and 680 lbs. of green stems. He pressed out 640 lbs. of stems in a sugar-mill, and boiled down the juice, which gave 15 *sirs* of raw sugar, or 4 lbs. of refined sugar and four bottles of spirits. This sugar was of good market value for refining,

worth 8s. to 14s. per cwt. If the proper methods had been used, from 10 to 15 lbs. of refined sugar, instead of 4 lbs., would have been obtained, which is a third the quantity produced from sugar cane. But the sugar is an extra product. In May 1880 Captain Pogson, at Koteghur, received red, white, striped, yellow, and purple Cuzco maize grains from Mr. Duffie of the Saharunpur gardens, which came up well, and in numerous instances the red Cuzco had hybridised with the ordinary kinds. The conclusion was that Cuzco maize might also be used to improve the ordinary Indian corn by hybridising; as the hybrids might be stronger while preserving the advantages of Cuzco maize. The results of the trials in suitable localities have been that Cuzco maize flourishes in the Western Himálayas at heights from 8000 to 4000 feet, especially at Ranikhet; that it produces abundant seeds; that as a source of food it is excellent and five times as prolific as ordinary maize; that the stalks produce sugar of good quality, and are most valuable as food for cattle; and that the plant will be serviceable for hybridising with ordinary Indian corn. Thus the introduction of Cuzco maize into India has been a useful and successful measure.

I also determined to introduce the *quinua* (*Cheno-podium quinua*) into India. It is cultivated at very great elevations in the Peruvian Andes, and yields abundantly a small but nutritious food grain. It seemed probable that *quinua* would grow well, under cultivation, at similar heights on the Himálayas, and might yield supplies of food in the lofty districts through which the trade routes pass to Eastern Turkistan and Tibet. There is a plant called *bathu* (*Cheno-podium album*) in the Punjab, resembling *quinua*, but very inferior to it, which is used for food, and also as a medicine. It grows in the plains, and is not a hill product. There is also an amaranth called *bathu*. But there is no Indian plant occupying the position of *quinua*, as a source of food supplied cultivated at very great elevations.

The earliest mention of the *quinua* grain of Peru occurs in the "Cronica" of Pedro de Cieza de Leon, an observant old soldier, who accompanied the army of La Gasca in his campaign against Gonzalo Pizarro in 1547. He says: "There is a food called *quinua*, the leaf of which is like an amaranth, and there are very small seeds, sometimes white and at others reddish. Of these seeds they make a drink, and also they eat them cooked, as we do rice." In another place he calls *quinua* the principal food of the people in the Collao of Peru.

The Ynca Garcilasso de la Vega, in the first part of his Royal Commentaries of Peru, also mentions the *quinua* plant. "Of the grains which are cultivated over the face of Peru, they give the second place to that called *quinua* by the natives. The plant on which it grows is very like the wild amaranth, in shape as well

as in the leaf and the flower. Both the Indians and the Spaniards eat the tender leaves in their dishes, because they are savoury and very wholesome. They also eat the grain in their soups, prepared in various ways. The Indians also make a beverage of the *quinua*, as they do of the maize, but only in districts where maize will not grow. The native herbalists use the flower of *quinua* to cure some diseases.

The brothers Ulloa, in the last country, thus describe the *quinua*:—"It resembles a lentil in shape, but is much smaller and very white. When boiled the grain opens, and out of it comes a spiral fibre, which appears like a small worm, but whiter than the husk of the grain. The stem is about 3 or 4 feet in height, and has a large pointed leaf. The flower is of deep red, and in it are contained the grains or seeds. The *quinua* is eaten boiled like rice, and has a very pleasant taste."

Von Tschudi pronounces *quinua* to be a nutritious, wholesome, and pleasant article of food. The leaves, before the plant attains full maturity, are eaten like spinach. The seeds are boiled in milk, or in broth, and are sometimes cooked with cheese and pepper. The dried stems are used as fuel.

Quinoa is cultivated in the higher parts of the Andes of Peru and Quito, and is the hardiest food grain in the world, growing at greater elevations above the level of the sea. In Quichua the cultivated plant is called *quinua*, the green leaves *lliccha*, the wild plant *azar*, pudding made of quinoa grains *pisque*, and the boiled grains dried in the sun, and ground into coarse powder for food on a journey, *quispiña*. There is a variety called *cañahua* grown extensively in the districts bordering on Lake Titicaca.

David Forbes describes the *quinua* seeds as exactly of the form and size of an ordinary mustard seed. "They are of a red, yellow, or white colour, in different varieties of the plant. The seeds must always be first well washed with water, to remove a bitter principle they contain, before cooking. When boiled they make an excellent porridge or pudding. The leaves of the young plant are eaten as salad, and a sort of fermented liquor is also made from them called *kupaccusa* in Aymara."

This remarkable food grain might doubtless be usefully cultivated in the loftier districts of the Himálayas, near the principal trade routes, such as Ladak and Sikkim; and I thought that, with this object in view, seeds might be forwarded to Darjiling and Leh, and intrusted to responsible persons who would take an interest in the cultivation. The plant flourishes at heights from 12,000 to 16,000 feet above the level of the sea, and supplies of wholesome food might thus be obtained in regions where corn will not ripen.

Two cwt. of *quinua* and *cañahua* seeds were accordingly shipped from the Peruvian port of Mollendo on September 4th, 1874, and arrived at Liverpool in November, whence they were forwarded to India. (*Peruvian Bark*, by C. R. Markham, C. B.)

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	Armstrong, Joseph Samuel, Esq., c. s., Pooree ..	1865
	Assistant Manager, Ting Ling Tea Co., Darjeeling...	1875
	Assistant Manager, Singbulli and Nurmah Tea Co., Limited, Darjeeling	1875
75	Assistant Commissioner, Jhansi ...	1877
	Atkinson, Alex., Esq., c. E., Etah ...	1877

B.

	BALKRISHNA, Rai, Benares	1878
	Banon, Lient. A., 39th N. I., Meerut ...	1877
	Banee Madhub Sen, Baboo, Calcutta ...	1875
80	Bannerman, Lt.-Col. P. W., Pol. Agent, Bhagelkund (Rewah)	1876
	Barber, H. W., Esq., Deputy Magistrate, Chittagong	1875
	Barker, Dr. R. A., Civil Surgeon, Bogra ...	1870
	Barlow, G. N., Esq., Civil Service, Bhaugulpore ...	1864
	Barron, Capt. W., Depy. Supdt., Revenue Survey, 4th or Moradabad District, Nynee Tal ...	1871
85	Barry, Dr. J. B., Calcutta	1877
	Barstow, H. C., Esq., Civil Service, Ghazipore ...	1868
	Battersby, Dr. W. E., Supdt. Central Jail, Bhaugul- pore	1878
	Bean, Mrs. E., Bankipore	1877
	Beaumont, Dr. Thomas, Residency Surgeon, Indore	1870
90	Beckett,* H. B., Esq., Depy. Commissioner ...	1876
	Beeby, G. O., Esq., Solicitor, Calcutta ...	1866
	Behari Lall Pyne, Baboo, Calcutta ...	1876
	Bell, H. C., Esq., Nurbong, Kurseong ...	1877
	Bennett, Walter H., Esq., Supdt., New Tea Concern, Assam	1873

B.—(Continued.)

		<i>Admitted.</i>
95	Benwell†, W. M., Esq., Calcutta ...	1876
	Beveridge, H., Esq., c. s., Rungpore ...	1865
	Bhugwan Chunder Bose, Behoo, Deputy Magistrate, Cutwa ...	1875
	Bignell, R. A. D'O., Esq., Assistant Superintendent of Police, Nya Doomka ...	1867
	Bimala Churn Bhattacharjea, Deputy Collector and Magistrate, Nowada, <i>viâ</i> Behar ...	1870
100	Binning, J., Esq., Calcutta ...	1877
	Blandford, A., Turtipore Indigo Concern, Malda ...	1875
	Blathwayt,* Capt., L., Assistant Commissioner ...	1871
	Blechynden, R., Esq., Merchant, Calcutta ...	1858
	Blechynden, A. H., Esq., Secretary, Agri-Hort. So- ciety of India, Calcutta ...	1851
105	Blyth, W. D., Esq., c. s., 24-Pergunnahs, Alipore ...	1876
	Boddam, Col., Hungerford, Hazareebaugh ...	1871
	Bond, T. T., Govt. Engineer, Cawnpore ...	1873
	Bonnaud, Arthur, Esq., Merchant, Calcutta ...	1873
	Bowers, Mrs., Bhuptani, Protoubunge, Bhaugulpore ...	1872
110	Bowser, Dr. H. C., Calcutta ...	1876
	Boxwell, J., Esq., c. s., Nya Doomka ...	1874
	Brae, T., Esq., Munjapara, Pubna ...	1854
	Brander,* James, Esq., E. B. Railway, Sealdah ...	1865
	Brandis, Dr. D., Inspector-General of Forests ...	1874
115	Branson, J. H., Esq., <i>Barrister-at-Law</i> , Calcutta ...	1874
	Bridgman, J. H., Esq., Goruckpore ...	1868
	Brodhurst, M., Esq., Civil Service, Benares ...	1859
	Broucke, W. J., Esq., Indigo Planter, Bhugha Fac- tory, <i>viâ</i> Chumparun ...	1859
	Broughton, E., Esq., Merchant, Calcutta ...	1865
120	Brown, Forbes Scott, Esq., Merchant, Penang ..	1840
	Brown,† H. F., Merchant, Calcutta ...	1875
	Brown, Lord Ulick, Civil Service, Calcutta ...	1876
	Bruce, H. W., Esq., Tea Planter, Tezpore, Assam ...	1876
	Bryce, J., Esq., Kallygunge, Rungpore ...	1877
125	Buck, E. C., Esq., c. s., Cawnpore ...	1870
	Bull, Alexis, Esq., Bambarria Tea Estate, Seeksagar, Assam ...	1875
	Burkinyoung, H. H., Oating Factory, Golaghat, Assam ...	1875
	Butler, Walter, Naga Doolia Factory, Jorehaut, Assam ...	1858
	Butt, Geo., Esq., Civil Service, Allahabad ...	1866

C.

130	CALDWELL, Jas., Esq., Emigration Agent for Natal, Garden Reach ...	1878
	Campbell,* D. W., Esq., Locomotive Supdt., E. I. Railway, Jamalpore ...	1870

C.—(Continued.)

Admitted.

	Campbell, A., Esq., Tea Planter, Manager, Michi Tea Estate, Kurseong	1872
	Campbell, W. A., Esq., Manager, Sungoo River Tea Plantation, Chittagong	1874
	Campbell, A. C., Esq., Offg. Depy. Commr., Goalpara	1877
135	Campbell, A. S., Esq., Tea Planter, Debrooghur	1877
	Cantonment Magistrate, Cawnpore	1873
	Cantonment Magistrate, Lucknow	1876
	Carleton, C. F., Esq., Indigo Planter, Meerpore, Moteeharry, Chumparun	1868
	Carnac, H. Rivett, Esq., c. s., Ghazee pore	1869
140	Carshore, Walter B., Nundinee Fy., Shapore, Oondee	1875
	Carritt,* Alfred, Esq., Merchant	1873
	Castle, C. T., Esq., Supdt. of Police, Ghazee pore	1865
	Chamarett, A., Esq., Surveyor Genl.'s Dept., Calcutta	1874
	Chambers, Chas., Esq., Calcutta	1878
145	Chapman, A. W., Esq., Broker, Calcutta	1877
	Chardon, W. B., Esq., Seepah Factory, <i>vid</i> Arrah	1864
	Charriol, F., Esq., Merchant, Calcutta	1875
	Chairman, Kishnaghur Municipality, Kishnaghur	1875
	Cheetham,* W. H., Esq., Merchant, Calcutta	1870
150	Chrestien, E., Esq., Bugha, Chumparun	1875
	Chunder Caunt Mookerjee, Baboo, Calcutta	1866
	Chunder Coomar Roy, Baboo, Norail	1876
	Chunder Kirtee Singh, Maharajah of Munnipore	1874
	Clark, Col. E. G., Settlement Officer, Sultanpore, (Oudh)	1872
155	Clarke, The Hon'ble Sir A., K. C. M., G. C. B.	1876
	Cogswell, W. H., Esq., Calcutta	1866
	Cole, Conductor Thos., Secundrabad, Deccan	1873
	Cole, Revd. J., Supdt. Lawrence Asylum, Sanawur	1865
	Collis, F. S., Esq., <i>Barrister-at-Law</i> , Calcutta	1871
160	Collier, F. R. S., Esq., c. s., Kurigaon, Rungpore	1875
	Cooke, Robin, Esq., Doolubcherra, Cachar	1878
	Coombe, Dr. F. S., Khagoul, Dinapore	1877
	Cooper, Dr. A. D., Civil Medical Officer, Naga Hills	1876
	Cornell, W., Esq., Civil Service, Midnapore	1861
165	Corse-Scott, Capt. J., 37th N. I., Bareilly	1826
	Cosserat, Lewis, Esq., Indigo Planter, Sarun	1859
	Cowie,* E. H., Esq., Merchant	1874
	Coxhead,* T. E., Esq., c. s., Moorshedabad	1875
	Creaton, W. E., Esq., Merchant, Calcutta	1875
170	Cresswell, W. S., Esq., Merchant, Calcutta	1874
	Cresswell, H. T., Esq., Banshut Factory, <i>vid</i> Musruck, Chnprah	1874
	Crisp, Ralph, Esq., Oating Factory, Golaghat, Assam	1877

C.—(Continued.)

Admitted.

	Crowdy, L. J., Esq., Munjowl Factory, Beguserai, Monghyr ...	1875
	Crosthwaite, R. J., Esq., B. A. C. S., Allahabad ...	1869
175	Cumming, W., Esq., Indigo Planter, Muniharee Factory, Sahebgunge ...	1851
	Cunningham, the Hon'ble H. S. ...	1878
	Currie, G. M., Esq., Civil Service, Motihari ...	1868

D.

	Dalbusset,* E., Esq., Merchant, Calcutta ...	1871
	Dalgliesh, E. W., Esq., Tea Planter, Dulsing Serai, Tirhoot ...	1873
180	Dallas, J. P., Esq., Dooars Tea Coy., Julpigoree ...	1877
	Daly, F. D., Esq., Manager, Simla Bank, Umballa ...	1867
	Daly, R. M., Esq., H. M., Bengal Marine, Calcutta ...	1869
	Darwood, J. M., Esq., Rangoon ...	1878
	Dashwood,* H. W., Esq., Civil Service ...	1860
185	David, M., Esq., Dacca ...	1878
	Davies,* Lieut.-Col., F. J. ...	1869
	Davies,* A., Esq., Calcutta ...	1874
	Davis, C. T., Esq., Solicitor, Calcutta ...	1874
	Davis, W. P., Esq., Bengal Police, Hooghly ...	1870
190	Davis, Major, R. P., Dist. Supdt. Police, Beerbhoom ...	1877
	Davison,* Capt., 15th King's Hussars ...	1872
	Davidson, James, Esq., Debrooghur, Assam ...	1870
	Dear, Herschel, Esq., Monghyr ...	1860
	Deas, C., Esq., N. B. State Ry., Luckunhatty ...	1874
195	Denham, C. H., Esq., C. E., Howrah ...	1874
	Deputy Commissioner of Sumbulpore ...	1866
	Deputy Commissioner of Ellichpore ...	1869
	Deputy Commissioner of Woon ...	1869
	Deputy Commissioner of Bassim, West Berar ...	1871
200	Deputy Commissioner of Akola, Berar ...	1875
	Desaran,* Edwd. Dubois, Esq., Aurungabad Factory, <i>vid</i> Pakour ...	1874
	DeSouza, W. E., Esq., Consul-Genl. for Portugal, Calcutta ...	1878
	Determes, T., Esq., Merchant, Chittagong ...	1873
	Deverell, H., Esq., Indigo Planter ...	1854
205	Dickens,* Col. C. H., Artillery ...	1856
	Dignam, S., Esq., Solicitor, Calcutta ...	1876
	D'Oyly, W. H., Esq., Civil Service, Bankipore ...	1872
	Dodgson, W., Esq., Kallygunge Factory, Rungpore ...	1864
	Dombal, Rohd. De, Esq., Manager, Hybutnugga Estate Kisharegunge, Mymensing ...	1872
210	Dombal M. E. Durup-de, Esq., Mymensing ...	1876

D.—(Continued.)

Admitted.

	Doyal Chund Dass, Baboo, Banian, Calcutta	...	1877
	Drouin, A., Esq., Acting Consul-Genl. for France, Calcutta	... ..	1878
	D'Silva, E. A., Esq., Asst. Dispensing Chemist, Calcutta	... ..	1873
	Duff, P., Esq., Sircuah, Narodnuggur, North Bhaugulpore	... ..	1875
215	Dunn, Lient. T. D. W., 62nd Regt., Morar	...	1873
	Dunne, M. P., Esq., Zemindar, Sumshabad, Azimgurh	...	1872
	Dwarka Nath Dutt, Baboo, Calcutta	...	1874

E.

	EDEN, Hon'ble Sir A., Lient.-Govr., Bengal, Alipore	...	1873
	Edgar, E. L., Esq., Cachar	...	1872
220	Egerton, Hon'ble R. E., Lient.-Govr., Punjab, Lahore	... ..	1864
	Eisenlohr, F., Esq., Merchant, Calcutta	...	1870

F.

	FARQUHARSON, J. G., Esq., Nunmati Garden, Gowhatty	...	1874
	Feltwell, J. W., Esq., Manager, Kookeecherra Garden, Cachar	... ..	1875
	Firth, H. A., Esq., Emigration Agent, Calcutta	...	1873
225	Fisher, Lient.-Col. G. B., Commandant, Fort Shabkodar, Peshawur	... ..	1865
	Fisher, J. H., Esq., c. s., Jubbulpore	...	1871
	Foley, E. G., Esq., Culleecherra Garden, Sylhet	...	1873
	Foley, W., Esq., Tea Planter, Sylhet	...	1877
	Forbes, A., Esq., Calcutta	...	1878
230	Francis, T. M., Esq., Solicitor, Muzufferpore, Tirhoot	...	1871
	Fraser, Ronald, Manager, Margaret's Hope Tea Estate, Hope Town, Darjeeling	...	1875
	Freeman, G. S., Esq., Lohoria Factory, Chumparun	...	1876
	Freeman, H., Esq., Lall Serriah Factory, Seegowly, Chumparun	... ..	1866

G.

	GALE,* M. H. L., Esq.	1873
235	Garbett, Capt. C. H., Asst. Commr., Lohardugga	...	1868
	Gardner, D. M., Esq., Civil Service, Azimgurh	...	1872
	Gardner, E. B., Dr., Civil Surgeon, Shajehanpore	...	1876
	Gard, Hon'ble Sir Richard, Chief Justice, High Court, Calcutta	... ..	1875
	Gibbon, T. M., Esq., Indigo Planter, Segoulie Factory, Chumparun	... ..	1874
240	Gibbon, W. F., Esq., Senr. Doolha Factory, Gorruckpore	... ..	1870

C.—(Continued.)

		Admitted.
	Gibbon, W. F., Esq., Turcoolah, Chumparun ...	1874
	Gilman, J. H. S., Sonapore Tea Factory, Gowhatty ...	1874
	Glass, J., Esq., Ex.-Engineer, D. P. W., Jubulpore...	1866
	Gocool Nath Chatterjee, Baboo, Calcutta ...	1874
245	Gocool Chunder Dutt, Baboo, Calcutta ...	1874
	Goonendra Nath Tagore, Baboo, Zemindar, Calcutta, Vice-President ...	1872
	Gopal Chunder Bose, Baboo, Kuranpal, <i>vid</i> Cuttack	1876
	Gopeenath Roy, Baboo, Calcutta ...	1871
	Gordon, D. T., Esq., Surdah ...	1859
250	Gordon, John, Esq., Bank of Bengal, Calcutta ...	1865
	Govind Loll Roy, Baboo, Zemindar, Tajhat, Rungpore	1877
	Graham, Wm. Francis, Esq., M. C. S., Chicacole ...	1871
	Grant, Thomas, Esq., Indigo Planter, Bhangulpore...	1848
	Grant, G. H., Esq., Indigo Planter, Bhangulpore ...	1859
255	Grant, C., Esq., Lebong, Darjeeling ...	1864
	Gray, Dr. E., Jorehaut, Assam ...	1875
	Gray, W., Esq., Merchant, Calcutta ...	1875
	Grey, * E., Esq., Civil Service ...	1868
	Grey, Lieut. Henry, Ranchee ...	1878
260	Grija Prosunno Mookerjee, Baboo, Zemindar, Gober- danga ...	1878
	Greenhill, * T., Esq. ...	1877
	Greenfield, W. H., Esq., Mountjoy Tea Estate, Poun daubray, Akyab ...	1877
	Grierson, G. A., Esq., c. s., Durbhangah ...	1877
	Griffiths, Ralph, Esq., Allahabad ...	1870
265	Grimley, J. E., Supt. Nizam's Garden, Hydrabad	1875
	Grimwood, F. St. C., Esq., c. s., Seebaugor, Assam	1878
	Groundwater, R., Esq., Tea Planter, Gowhatty, Assam	1875
	Guise, * J. J., Esq., Merchant ...	1867
	Gupta, K. G., Esq., c. s., Perozepore, Backergunge...	1877

H.

270	HADENFELDT, R., Esq., Merchant., Calcutta ...	1874
	Haines, H. E. Genl. Sir F. P., G. C. B ...	1878
	Halford, Charles, Esq., Bill-Broker, Calcutta ...	1872
	Harding, F., Esq., c. s., Serampore ...	1877
	Harman, A. L., Esq., Jatepore Factory, Chupra ...	1876
275	Harris, J., Esq., Sykotta Tea Garden, Jorehat, Assam	1877
	Harrison, Augustus S., Esq., Principal of the Mnir College, Allahabad ...	1873
	Harish Chunder Roy, Baboo, Supdt., Bakirbund Estate, Rungpore ...	1877
	Hartnell, * M., Esq. ...	1876
	Hawkins, * Major E. L., R. A., Mean Meer ...	1871
280	Hawkins, R. W. L., Esq., Deoband, S. P. and D. Railway ...	1877

H.—(Continued.)

		Admitted.
	Haxell, Cleland, Esq., Koliabar, Nowgong, Assam...	1877
	Hay,* John, Esq., Merchant, Calcutta ..	1876
	Hayes, G., Esq., Zemindar, Purneah ...	1876
	Head Gardener of the Ram Nawas, Jeypore ...	1876
285	Health Officer, Calcutta ...	1865
	Heindricks, J., Esq., Merchant, Akyab ..	1878
	Helps, W., Esq., Manager, Fallowdhi Tea Co., Dar- jeeling ...	1875
	Hem Chunder Goossami, Baboo, Serampore ...	1877
	Henderson, Dr. Geo., Rawul Pindee ...	1876
290	Hill, Dr. J. H. G., Turcooleah Factory, Moteeharee, Chumparun ...	1865
	Hill, R. H., Esq., Seraba, Tirhoot ...	1865
	Hindmarsh, Thomas, Esq., Eastern Bengal Railway, Kancharapara ...	1866
	Hittoll Messer, Baboo, Zemindar, Mauncoor ...	1864
	Hobhouse,* Hon'ble Arthur ...	1872
295	Hobson, E. A., Esq., Merchant, Calcutta ...	1875
	Hogg, Capt. T. W., Asst. Commissioner, Jubbulpore	1868
	Holmes, R. A. K., Dr., Supdt. Central Prison, Meerut	1876
	Howard, Edwd., Esq., <i>Barrister-at-Law</i> , Allahabad...	1878
	Hudson, C. K., Esq., Cherrapoonjee ...	1874
300	Hunter, J. K., Esq., Koopili Tea Estate, Assam ...	1870
	Hutchison, J. H., Esq., Merchant, Calcutta ...	1876

I.

	INGLIS, A. B., Esq., Merchant, Calcutta ...	1873
	Inskip, C. T., Esq., Merchant, Calcutta ...	1870
	Imthurn,* Dr. A., M. D. ...	1873
305	Ishore Pershaud Narain Singh, Bahadoor, Maharajah of Benares ...	1854.

J.

	Jack,* E. A., Esq., Merchant, Calcutta...	1863
	Jackson, Hon'ble L. S., c. s., c. i. e., Calcutta, <i>President</i> ...	1852
	Jackson, W. G., Esq., c. s., Rangoon ...	1876
	James, A. H., Esq., Durbhangan ...	1878
310	Janoki Bullub Sen, Baboo, Zemindar of Dimla, Rangpore ...	1877
	Jefferson, W. E. S., Esq., Debrogur, Assam ...	1875
	Jenkinson, E. G., Esq., c. s., Fyzabad ...	1874
	Jennings,* F., Esq., Calcutta ...	1874
	Jerdon, C. M., Esq., Sub-Deputy Opium Agent, Tirhoot ...	1873
315	Jogendro Nath Mullick, Baboo, Calcutta ...	1877

J.—(Continued.)

		Admitted.
	Johnson, H. Luttman, Esq., Civil Service, Sylhet ...	1873
	Johnstone, Lieut.-Col., J., Political-Agent, Munneepore ...	1871
	Jones, W. H., Esq., Calcutta ...	1862
	Joykissen Mookerjee, Baboo, Zemindar, Ooterpara...	1852
320	Juggut Singh Koer, Tajpore, <i>viâ</i> Bijnour ...	1874
	Juggut Jung Bahadoor, Rana, Nepaul ...	1878
	Jung Bahadoor, Rai, Zemindar, Butra, Tirhoot ...	1878

K.

	KALKE Kissen Tagore, Baboo, Calcutta...	1869
	Kali Prosunno Ghose, Baboo, Calcutta...	1877
325	Kally Prosunno Roy, Baboo, Zemindar, Cossipore ...	1867
	Kalberer, J., Esq., Kotahi Factory, Goruckpore ...	1875
	Kemp, Geo. Lucas, Esq., F. R. G. S., Calcutta ...	1871
	Kidd, Dr. H. A., Civil Surgeon, Mundla ...	1871
	Kilby*, W., Esq., District Supdt. of Police ...	1875
330	Kincaid, Lieut.-Col. W., Pol. Agent, Bhopal, Sehore ...	1867
	King, Dr. Geo., Supdt. Royal Botanical Garden, Calcutta, ...	1872
	Kirkpatrick*, Clarence, Esq., Delhi ...	1874
	Kirpatrick, C. S., Esq., The College, Delhi ...	1878
	Kisch,† H. M., Esq., C. S. ...	1876
335	Kishen Chunder Bhunge, Rajah of Killoh, Mohurbhunge, Cuttack ...	1874
	Knaggs, Walter, Esq., Trafalgar Estate, Singapore ...	1878
	Knox, G. E., Esq., C. S., Allahabad ...	1875
	Knyvett, Major, W. L. N., District Supdt. of Police, Purneah ...	1864
	Komul Krishna Deb Bahadoor, Rajah, Calcutta ...	1874
340	Krishnadhun Ghose, Dr., Civil Surgeon, Rungpore ...	1874

L.

	LARMINIE, W. R., Esq., Civil Service, Burdwan ...	1862
	Lawrence, Capt. H., Depy. Commr., Sirsa, Punjab...	1877
	Lazarus, F. A., Esq., Calcutta ...	1874
	Lees,† Col. W. M., Under-Secretary, Govt. of India, Military Dept. ...	1871
345	Leibert, M., Esq., Tea Planter, Hazareebaugh ...	1863
	Leitch,* Henry Joseph, Esq., Broker, Calcutta ...	1872
	Leslie, S. J., Esq., Solicitor, Calcutta ...	1873
	Levinge, H. C., Esq., C. K., Calcutta ...	1863
	Llewellyn, Stanley, Esq., Chitwarrah Factory, Mozufferpore ...	1876
350	Lloyd, M., Esq., Indigo Planter, Shapoor Oondee, Tirhoot ...	1863

L.—(Continued.)

Admitted.

	Luchmееput Sing, Roy, Bahadoor, Banker, Calcutta	1864
	Luchmessur Sing, Bahadoor, Zemindar, Durbungah, Tirhoot	1861
	Lukin,* Major F., 3rd Hussars, Mhow, Central India	1860
	Lushington,* H., Esq., c. s.	1865
355	Lyall, D. R., Esq., Civil Service, Dacca	1869
	Lyall, R. A., Esq., Merchant, Calcutta	1875
	Lynam, John, Esq., Supdt. Reserve Police Force, Calcutta	1866
	Lynch, Dr. Sydney, Supdt. of Jail, Alipore	1872
	Lyon, W., Esq., Asst. Commr., Sambhurlake, Rajpootana	1875

M.

360	MACALLISTER, R., Esq., Merchant, Calcutta	1872
	MacBean, Duncan, Esq., Paror Tea Estate, Kangra Valley	1876
	Macdonald,* Aeneas J., Esq., Lohurreah Factory	1872
	Macdonald, James, Esq., c. E., Allyghur	1874
	Mackillican, J., Esq., Merchant, Calcutta	1865
365	Mackinnon,† D., Esq., Merchant, Calcutta	1874
	Mackinnon,† John, Esq., Merchant, Calcutta	1875
	MacIachlan, J. E., Esq., Merchant, Calcutta	1861
	Maclean, Hon'ble A. T., Civil Service, Calcutta	1858
	Macmillan, J., Esq., c. E., Cuttack	1865
370	Macnamara, J. A., Esq., c. E., Dist. Engineer, Shahabad	1877
	Macpherson, W., Esq., Civil Service, Cuttack	1861
	Maddock, H. R., Esq., Tea Planter, Chittagong	1877
	Maharajah of Betteah, Tirhoot	1870
	Maharajah of Cooch Behar	1864
375	Manager, Balasun Tea Co., Darjeeling	1875
	Manager, Amluckee Tea Company, Assam	1877
	Manager, Bengal Tea Company, Cachar	1867
	Manager, Bisnath Tea Co., Assam	1875
	Manager, Borsillah Tea Co., Assam	1875
380	Manager, Brahmapootra Tea Co., Assam	1875
	Manager, Burruusal Garden, Sylhet	1876
	Manager, Boroomcherra Tea Garden, Cachar	1876
	Manager, Central Cachar Tea Co.	1875
	Manager, Central Terai Tea Co., Darjeeling	1875
385	Manager, Chenga Tea Association, Darjeeling	1875
	Manager, Chincoorie Tea Co., Cachar	1875
	Manager, Chumta Tea Association, Darjeeling	1875
	Manager, Chunderpore Tea Garden, Assam	1875
	Manager, Chundypore Tea Company, Cachar	1862
390	Manager, Cutlee Cherra Garden, Cachar	1865
	Manager, Dahingapore Factory, Assam	1865

III.—(Continued.)

Admitted.

	Manager, Dessai and Purbuttea Tea Company, Jorehant, Assam	...	...	1874
	Manager, Durrung Tea Company, Assam	...	...	1877
	Manager of Dewkonall Estate, Cuttack	...	...	1871
395	Manager, East India Tea Company, Assam	...	...	1865
	Manager, East India Tea Company, Cachar	...	...	1866
	Manager, Elambazar Indigo Concern, Bhulpore	...	...	1877
	Manager, Gellhutting Tea Estate, Assam	...	...	1877
	Manager, Giell Tea Co., Darjeeling	...	...	1875
400	Manager, Goomrah Factory, Tirhoot	...	...	1865
	Manager, Government Garden, Fyzabad, Oudh	...	...	1871
	Manager, Government Garden, Gondah, Oudh	...	...	1875
	Manager, Greenwood Tea Garden, Assam	...	...	1875
	Manager, Halmara Tea Estate, Assam	...	...	1870
405	Manager, Hoolmaree Tea Co., Assam	...	...	1875
	Manager, Hoolungurree Tea Co., Assam	...	...	1878
	Manager, Hunhall Tea Estate, Jorehaut, Assam	...	...	1874
	Manager, Jokie (Assam) Tea Co., Assam	...	...	1875
	Manager, Julnacherra Tea Garden, Cachar	...	...	1875
410	Manager, Joypore Garden, Cachar	...	...	1865
	Manager, Kalinbar Tea Estate, Assam	...	...	1876
	Manager, Kallacherra Tea Company, Cachar	...	...	1862
	Manager, Kallian Tea Garden, Cachar	...	...	1874
	Manager, Kamptee Gwallie Tea Estate, Debrooghur	...	...	1875
415	Manager, Kanchunpore Tea Company, Cachar	...	...	1862
	Manager, Kassomaree Tea Garden, Assam	...	...	1875
	Manager, Kobira Tea Estate, Mungledye, Assam	...	...	1877
	Manager, Koeyah Factory, Cachar	...	...	1865
	Manager, Coomber Tea Garden, Cachar...	...	...	1875
420	Manager, Koomtar Tea Garden, Assam	...	...	1869
	Manager, Lalla Mookh Tea Garden, Cachar	...	...	1875
	Manager, Luckimpore Tea Co., Assam	...	...	1875
	Manager, Luckwah Tea Garden, Assam	...	...	1875
	Manager, Majagram Tea Co., Cachar	...	...	1875
425	Manager, Majulighur Tea Estate, Assam	...	...	1875
	Manager, Mandakatta Tea Estate, Assam	...	...	1875
	Manager, Monacherra Tea Garden, Cachar	...	...	1875
	Manager, Moran Tea Co., Sebsangor, Assam	...	...	1875
	Manager, Margaret Hope Tea Plantation, Darjeeling	...	...	1876
430	Manager, Massempore Tea Garden, Cachar	...	...	1875
	Manager, Mattegurrah Tea Concern, Darjeeling	...	...	1877
	Manager, Mesia Jan Tea Estate, Debrooghur	...	...	1875
	Manager, Munguldye Tea Co., Assam	...	...	1875
	Manager, Muttuk Tea Co., Assam	...	...	1878
435	Manager, Naga Dhoolie Tea Garden, Assam	...	...	1876
	Manager, Narainpore Garden, Cachar	...	...	1865
	Manager, New Golaghat Assam Tea Company, Assam	...	...	1874

M.—(Continued.)

		Admitted.
	Manager, Noakacharee Tea Company, Assam ...	1865
	Manager, Nooabaree Tea Estate, Assam ...	1878
440	Manager, Nuddea Ward's Estate, Kishnaghur ...	1875
	Manager, Pattareah Tea Co., Sylhet ...	1875
	Manager, Phoenix Tea Co., Cachar ...	1878
	Manager, Public Garden, Etawah ...	1874
	Manager, Punkabaree Tea Co., Punkabaree ...	1878
445	Manager, Roopacherra Tea Garden, Cachar ...	1875
	Manager, Scottish Assam Tea Co., Assam ...	1875
	Manager, Selong Tea Estate, Shillong ...	1867
	Manager, Silcoorie Tea Garden, Cachar ...	1875
	Manager, Singbulli & Nurmah Tea Co., Ltd., Darjeeling ...	1875
450	Manager, Singell Tea Company, Darjeeling ...	1874
	Manager, Sissobari Garden, Julpigoree ...	1877
	Manager, Sonai Tea Co., Cachar ...	1877
	Manager, Springside Tea Garden, Kurseong ...	1875
	Manager, Tarrapore Tea Garden, Cachar ...	1871
455	Manager, Teendarea Tea Company, Darjeeling ...	1874
	Manager, Teesta Valley Tea Association, Darjeeling ...	1875
	Manager, Terihannah Tea Plantation, Darjeeling ...	1876
	Manager, Tingri Tea Estate, Assam ...	1875
	Manager, Tukvar Tea Co. Darjeeling ...	1878
460	Masters, C. C., Esq., Barrister-at-Law, Bankipore ...	1878
	Mandelli, L., Esq., Tea Planter, Darjeeling ...	1868
	Manook, Dr. S. J., Civil Surgeon, Chyebassa ...	1866
	Martin, John, Esq., Calcutta ...	1874
	Martin, W. R., Esq., Tea Planter, Punkabaree, Dar- jeeling ...	1868
465	McFarlane, A. C., Esq., Merchant, Calcutta ...	1870
	McIntosh, A. R., Esq., Merchant, Calcutta ...	1872
	Melville,* S. S., Esq., c. s., ...	1875
	Mess Secretary, 42nd Assam Light Infantry, Gowhatti ...	1877
	Mess Secretary, 44th N. I., Shillong ...	1878
470	Meugens, J. G., Esq., Merchant, Calcutta ...	1865
	Mewburn,* G. F., Esq., Merchant ...	1874
	Michea, P., Esq., Daodchurn Factory, Benares ...	1875
	Middleton, C. J., Esq., P. W. D., Gya ...	1876
	Miller, Lieut-Col., F. J., Goordaspore ...	1869
475	Minchin, F. J. V., Esq., Aska, Ganjam ...	1862
	Mitchell, R. W. S., Esq., Emigration Agent for Trinidad, 9, Garden Reach ...	1875
	Mohendro Lall Bose, Baboo, Zemindar, Kaksiali, <i>via</i> Chinsurah ...	1877
	Moir, Dr. W., Civil Surgeon, Meerut ...	1872
	Mohima Rungun Roy Chowdry, Zemindar, Kakinia, Rungpore ...	1865

附一—(Continued.)

		Admitted.
480	Mohendrolall, Khan, Koomar, Narajole, Midnapore ...	1871
	Moore, O. W., Esq., c. s., Bareilly ...	1865
	Moran, F. C., Esq., Woodbine Factory, Debroghur, Assam ...	1870
	Morris,* E., Esq., Manager, Hong-Kong and Shanghai Banking Corporation, Calcutta ...	1874
	Morris, G. G., The Honorable, Civil Service, Judge, High Court, Calcutta ...	1872
485	Mosely, T. H., Esq., Merchant, Calcutta ...	1862
	Mullen, Dr. T. French, Residency Asst. Surgeon, Ulwar, Rajpootana ...	1871
	Murray, J. L. K., Esq., Higli Mari Garden, Nowgong	1876

N.

	NARAYAN Rao, Maharajah of Dewass, Indore ...	1874
	Nassiruddeen Ahmed Moulvi, Behar ...	1876
490	O'Donoghue, c. R., Esq., Puttabong Tea Estate, Darjeeling ...	1878
	Nehalchand, Baboo, Zemindar, Mozuffernagore ...	1877
	Newson, W. H., Esq., Merchant, Calcutta ...	1876
	Newton, W. H., Esq., Merchant, Calcutta ...	1875
	Nickele, C., Esq., Indigo Planter, Pesewa Factory, Jounpore ...	1866
495	Nilladhur Sing Deo Bahadoor, Feudatory Chief of Killa, Sonopore ...	1874
	Nobin Chand Bural, Baboo, Solicitor, Calcutta ...	1874
	Nogendra Nath Mullick, Baboo, Zemindar, Andool ...	1874
	Nolan, Phillip, Esq., Civil Service, Dinapore ...	1874
	Noor Khan, Huzrut, Minister of Jowrah ...	1874
500	Nundlall Bose, Baboo, Zemindar, Calcutta ...	1875

O.

	OBHOYCHURN Goho, Baboo, Merchant, Calcutta ...	1856
	Odling, O. W., Esq., c. s., Arrah ...	1871
	O'Donoghue, C. A. Esq., Pattarlong Tea Estate, Darjeeling ...	1878
	O'Keefe, J. W., Esq., Merchant, Calcutta ...	1871
505	Oldfield, R. C., Hon'ble, c. s., Allahabad ...	1875
	Oldham,* Wilton, Esq., L. L. D., Civil Service ...	1867
	Omesh Chunder Dutt, Esq., Calcutta ...	1874
	Orr, Major Alexander P., Roy Bareilly, Oudh ...	1868
	Osborne, Col. Willoughby, F. R. G. S., F. G. S., Sehore, Bhopal ...	1862
510	Osborne, Lt.-Col. J. H. Willoughby, Cawnpore ...	1870

P.

Admitted.

	PARCELL, W. G., Esq., Dehing Tea Co., Assam	...	1877
	Peal, S. E., Esq., Tea Planter, Sapakatee, Seeb-saugor, Assam	...	1867
	Peel, Fredk., Esq., Merchant, Calcutta	...	1871
	Peppè, G. T., Esq., Ranchee	...	1872
515	Peppè, T. F., Esq., Arrah	...	1868
	Peppè, W., Esq., Birdpore, Gorruackpore	...	1875
	Perrin, Monsr. J., Silk Filatures, Berhampore	...	1859
	Peter, James, Esq., Lydiacherra Garden, Cachar	...	1872
	Phillips, J., Esq., Manager, Government Farm, Allahabad	...	1875
520	Phipps, S. U., Esq., Calcutta	...	1874
	Pickance, * Capt. W. John, Madras Staff Corps	...	1867
	Pigott, * William, Esq., Broker	...	1864
	Pinney, G. F., Esq., Cinnamara Factory, Jorehaut, Assam	...	1871
	Plowden, W. C., Esq., c. s., Meerut	...	1876
525	Pocock, R. J. M., Esq., District Superintendent of Police, Etawah	...	1877
	Political Agent for Supdt., Rajkumar College, Bundelkund	...	1876
	Political Agent of Morar, Gwalior	...	1873
	Pont, V., Esq., Engineer, Sutna	...	1877
	Pooroo Chunder Roy, Rajah, Zemindar, Sarapooly	...	1870
530	Pott, A. C., Esq., Merchant, Calcutta	...	1878
	Prannath Pundit, Baboo, Bhowanipore...	...	1877
	Pratapa Chandra Ghosa, Baboo, Calcutta	...	1869
	Prendargast, Lt.-Col., G. A., 15th B. C., Cawnpore...	...	1876
	Prentis, Dr. C., Goruckpore	...	1878
535	Preo Nath Sett, Baboo, Calcutta	...	1876
	Pringle, R. B., Esq., Badalipur Tea Garden, Assam	...	1870
	Proprietors, Jugdispore Estate, Beeheea, Shahabad	...	1869
	Protheroe, Major Montague, Dy. Supdt., Port Blair	...	1869
	Presono Coomar Banerjee, Baboo, Calcutta	...	1871
540	Purna Nundo Barooa, Baboo, Extra Assistant Commissioner, Assam	...	1877
	Pyne, R., Esq., Putalpore, Silligoori	...	1867

Q.

QUINTON, J. W., Esq., Civil Service, Jhansi	...	1865
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R.

RAJENDRO Nath Mookerjee, Baboo, Calcutta	...	1878
Ramanymohun Chowdry, Rai Babadoor, Zemindar, Bungalow	...	1861

R.—(Continued.)

		Admitted.
545	Rampini, * R. F., Esq., c. s. ...	1875
	Ramsay, Herbert, Esq., Tea Planter, Kurseong ...	1878
	Ravenshaw, * T. E., Esq., Civil Service ...	1865
	Rayson, J., Esq., Manager, Behpara Tea Garden, Debrooghur ...	1877
	Reed, F. T., Esq., Hetampore, Beerbhoom ...	1878
550	Reid, J. R., Esq., c. s., Azimgurh ...	1866
	Reilly, Herbert, Esq., Depy. Magistrate, Maldah ...	1872
	Riach, F. S. M., Esq., Rungagora, Debrughur, Assam ...	1870
	Ridge, W., Esq., Soorsah Factory, <i>viâ</i> Rajshahye ...	1866
	Ritchie, D. W., Esq., Offg. District Supdt. of Police, Chyebassa ...	1871
555	Roberts, C., Esq., Kurseong, Darjeeling ...	1878
	Robinson, S. H., Esq., Merchant, Calcutta, <i>Vice- President</i> ...	1854
	Romesh Chunder Mittra, the Hon'ble, Calcutta ...	1874
	Rose, R., Esq., Inspector Postal Department, Luck- now ...	1877
	Rowett, R., Esq., Merchant, Rangoon ..	1877
560	Ruddock, E. H., Esq., B. C. S., Malda ...	1868
	Runglall Sing, Baboo, Bhaugulpore ...	1876
	Russell, T. M., Esq., Merchant, Calcutta ...	1868

S.

	SAGORE Dutt, Baboo, Merchant, Calcutta ...	1855
	Samachurn Law, Baboo, Merchant, Calcutta ...	1850
565	Samanand De, Bahadoor Rai, Balasore... ..	1875
	Samuells, * W. L., Major, Political Agent ...	1875
	Sanders, Dr. R. C., Moradabad ...	1875
	Sandys, Edwin F., Esq., Chittagong ...	1877
	Sandys, Mrs. Annie, Bhaugulpore ...	1870
570	Sandford, J. R., Esq., Monsumbul Tea Estate, Palum- pore ...	1877
	Savi, Thomas, Esq., Indigo Planter, Moisingunge, <i>viâ</i> Kishnaghur... ..	1851
	Scarth, Edwd., Esq., Ningri Ting Tea Factory, Assam ...	1878
	Sceales, Jaffray O'Brien, Esq., Bancoorah ...	1869
	Scott, T. W., Esq., Assistant Engineer, Booland- ghuhur ...	1875
575	Secretary, Assam Company, Calcutta ...	1865
	Secretary, Agricultural Society, Satkhira ...	1871
	Secretary, Cantonment Public Garden, Agra ...	1865
	Secretary, Cantonment Fund Committee, Morar ...	1878
	Secretary, Local Funds, Raepore ...	1874
580	Secretary, Local Fund Committee, Ferozepore ...	1861

§.—(Continued.)

		Admitted.
	Secretary, Local Fund, Nimar, Khundwa ...	1873
	Secretary, Local Committee, Betul ...	1874
	Secretary, Local Committee, Jhansi ...	1877
	Secretary, Municipal Committee, Mirzapore ...	1869
585	Secretary, Municipal Committee, Prome ...	1876
	Secretary, Municipal Committee, Goruckpore ...	1877
	Secretary, Municipality of Mau, Ranipore, Jhansi ...	1878
	Secretary, Public Garden, Azimghur ...	1871
	Secretary, Public Garden, Banda ...	1855
590	Secretary, Public Garden, Jaloun, Oorai ...	1866
	Secretary, Public Garden, Benares ...	1875
	Secretary, (Hony.) Planter's Club, Mozufferpore ...	1877
	Secretary, Public Garden, Rungpore ...	1877
	Secretary, Public Garden, Nowgong, Bundelkhund... 1877	
595	Secretary, Queen's Garden, Delhi ...	1873
	Secretary, Road Fund Committee, Jaunpore ...	1867
	Sells, A., Esq., c. s., Mozuffernuggur ...	1874
	Shaw*, Dr. John Cardy, Civil Surgeon, Arrah ...	1873
	Shabiuddin, Shaik, Nowada, Behar ...	1878
600	Sherer, * J. W., Esq., Civil Service ...	1869
	Sheoraj Sing, Rajah, c. s. i., Kasipore, Naineetal ...	1877
	Sherlock, J. E., Esq., Calcutta ...	1878
	Sherriff, W., Esq., Jorroda, Jessore ...	1859
	Shillingford, J. L., Esq., Kolassy Factory, Purneah ...	1865
605	Shillingford, G. W., Esq., Kolassy Factory, Purneah ...	1867
	Showers, St. Geo. A., Esq., Cinnamara Factory, Jore- haut, Assam ...	1875
	Shumsheer Jung, Nawab, Hyderabad ...	1878
	Simons, C. J., Esq., Tea Planter, Loajahir Factory, via Amgoori, Upper Assam ...	1863
	Simson, James, Esq., Civil Service, Allahabad ...	1856
610	Skinner, A., Esq., Mussoorie ...	1854
	Sladen, J., Esq., c. s., Saharunpore ...	1876
	Smallwood, A. E., Esq., Broker, Calcutta ...	1875
	Smith, G. M., Esq., Joyhinga Tea Estate, Luckim- pore, Assam ...	1871
	Smith, Dr. H. S., Civil Surgeon, Allahabad ...	1875
615	Smith, * Maxwell, Esq., Hursingpore, Tirhoot ...	1869
	Smith, W. E., Esq., Dickhora Garden, Nowgong, Assam ...	1875
	Smith, W., Esq., Dorunda Factory, Chota Nagpore ...	1872
	Smith, W. M., Esq., Nya Doomka, S. Pergunnahs ...	1878
	Sparks, H. J., Esq., c. s., Lucknow ...	1876
620	Spencer, Harrison, Esq., Tea Planter, Darjeeling ...	1874
	Speid, James, Esq., Hobeegunge, via Dacca ...	1875
	Sri Mohun Thakur, Baboo, Berarie, Bhaugulpore ...	1877
	Stalkartt, William, Esq., Merchant, Calcutta Vice- President ...	1845

§.—(Continued.)

		Admitted.
	Stalkartt* J., Esq., Hope Town, Darjeeling ...	1868
625	Staunton, R. S., Esq., Calcutta ...	1878
c	Steel, Octavius, Esq., Merchant, Calcutta ...	1874
	Steel, Donald, Esq., Eastern Cachar Tea Company, Cachar ...	1861
*	Stevens*, G. C., Esq., Civil Service ...	1875
	Stevens, H. W., Esq., Supdg. Engr., Durbhangah ...	1867
630	Stevenson, Geo., Esq., Civil Service, Mymensing ...	1873
	Stewart,* James, Esq., Civil Engineer ...	1873
	Stewart, R. D., Esq., Julpigoree... ..	1873
	Stokes, Allen, Esq., E. I. Railway, Jamalpore ...	1867
	Stokoe, T. R., Esq., Barrister, Calcutta ...	1878
635	Stone, C. G., Esq., Bokahala Factory, Jorehaut, Assam ...	1875
	Stratton, J. P., Esq., Political Agent, Nowgong, Bundelkhund ...	1873
	Studd, E. J. C., Esq., Dhoolea Factory, Tirhoot ...	1875
	Sturmer, A. J., Esq., Talooka Kajah, Cheriakote, P.O. Zumaneah ...	1866
	Sukharam Martund, Esq., Indore ...	1872
640	Sumbhoo Narayana, Rajah Bahadoor, Benares ...	1872
	Supdt., Govt. Model Farm, Cawnpore ...	1875
	Superintendent, Rambagh, Umritsur... ..	1859
	Superintendent, Taj Garden, Agra ...	1874
	Superintendent of the Patna Lunatic Asylum, Patna ...	1872
645	Superintendent, Central Prison, Benares ...	1871
	Superintendent of Jorehaut Tea Company, Assam ...	1865
	Superintendent, Serajung Jute Compy., Serajung ...	1868
	Superintendent, European Lunatic Asylum, Calcutta, Bhowanipore ...	1878
	Superintendent, Nuddea Jail, Kishnaghur ...	1878
650	Superintendent, Botanical Gardens, Saharunpore ...	1878
	Surdharee Lal, Baboo, Zemindar, Bhaugulpore ...	1874
	Sutherland, Charles J., Esq., Merchant, Calcutta ...	1838
	Sutherland,* H. H., Esq., Merchant ...	1870
	Sutherland, A. B., Esq., Merchant, Calcutta ...	1870
655	Swaine, G., Esq., Ottur Factory, Tirhoot ...	1875
	Swinhoe, William, Esq., Attorney, Calcutta ...	1859
	Syed Wilayat Ali Khan, Patna ...	1876

I.

	TAKIL Sedenath Sing, Zemindar of Keracally ...	1874
	Takeda, Mr. George, Interior Dept., Japan ...	1878
660	Tayloe, J. E., Esq., Merchant, Barrackpore ...	1875
	Taylor, W. C., Esq., Khoordah, Orissa ...	1858
	Taylor, Frank, Esq., Executive Engineer, Calcutta... ..	1868
	Taylor, S. H. C., Esq., c. s., Beerbhoom... ..	1873

I.—(Continued.)

		Admitted.
	Tennant, Col. J. F., Mint Master, Calcutta ...	1874
665	Terveen, W., Esq., Calcutta ...	1877
	Thomas, G., Esq., Zemindar, Monghyr ...	1875
	Thomas, J., Esq., Merchant, Calcutta ...	1867
	Thompson,* H., Esq. ...	1876
	Thornhill, E. B., Esq., Civil Service, Banda ...	1875
670	Toomey, Geo., Esq., Indigo Planter, Contai, Tirhoot.	1870
	Tottenham, L. B., Esq., Civil Service, Calcutta	1878
	Tucker, Robert, Esq., Tea Planter, Seeksangor	1867
	Turnbull, R., Esq., Calcutta ...	1878
	Turner, H. B. H., Esq., Merchant, Calcutta	1868
675	Twynam, Lt.-Col., E. J. L., Executive Officer, Rangoon	1856
	Tyler, Dr. J. W., Agra ...	1878

V.

	VENAYK Rao, Gunpat Kilia Sahaib, Indore ...	1872
	Vernan, John, Esq., Executive Engineer, Debrooghur	1871
	Vizianagram, His Highness the Rajah of ...	1847
680	Voss, C. W., Esq., Merchant, Parla-Kimidi, Ganjam	1874

W.

	WALKER, William, Esq., Tea Planter, Seeksangor, Upper Assam ...	1870
	Wallace, Adolphus, Esq., Rungajann Factory, Golaghaut, Assam ...	1866
	Wallace, G., Esq., Doria Factory, Golaghaut, Assam	1875
	Wallace, J. N., Esq., Loojan Tea Concern, Assam ...	1877
685	Walton, T., Esq., N. B. State Railway, Nattore ...	1878
	Ward, W. E., Esq., Civil Service, Gowhattee, Assam	1873
	Ward, G. E., Esq., c. s., Jounpore ...	1878
	Waterfield, William, Esq., Civil Service, Calcutta ...	1870
	Watt, George, Dr., Educational Service, Hooghly ...	1875
690	Webster, Alex. L., Esq., Tea Planter, Nutwanpore (Sylhet) ...	1867
	Welborne, J. E., Esq., Tea Planter, Jeypore, Assam	1877
	West, R. Barton, Esq., Calcutta ...	1876
	Westfield, W. F., Esq., Calcutta ...	1876
	White, C. P., Esq., Bullis Gooria Tea Garden, Nowgong, Assam ...	1876
695	White, H. F., Esq., Ex-Engineer, Nagode ...	1875
	White, Dr. J. B., Gowhatti ...	1872
	Whitney, F., Esq., Merchant, Calcutta ...	1875
	Whitty, Irwin, J., Esq., Civil Engineer, E. I. Railway, Chord Line, Giridhi ...	1867
	Wilcox, Frederick, Esq., Bengal Police, Dinagepore	1876
700	Wilkinson,* Major A. E. ...	1862
	Wilkinson, C. J., Esq., Barrister-at-law, Rangoon ...	1870

W.—(Continued.)

		Admitted.
	Wilkinson, Capt. C. J., Supt., P. & O. Company, Calcutta	1878
	Williams, J. Walter, Esq., Dist. Supdt. Police, N. W. P., Mozuffernagore	1877
	Williamson, Capt. W. J., Deputy Commr., Garrow Hills, Assam... ..	1867
705	Williamson, W. P., Esq., Supdt., Wilton Tea Co., Deb- rooghur, Assam	1877
	Wilmot, C. W., Esq., Asst. Commr., Sonthal Per- gunnahs, Deoghur	1876
	Wilson, Major-Genl., H. M., Sutah, <i>viâ</i> Palumpore, Punjab	1860
	Wilson, H. F., Esq., Serajgunge	1870
	Wilson, the Hon'ble Mr. Justice, High Court, Calcutta	1878
710	Wood,* Dr. A., Goruckpore	1875
	Woodman,* J. V., Esq., <i>Barrister-at-law</i>	1875
	Wood-Mason,* J., Esq., Asst. Curator, India Museum, Calcutta	1877
	Worgan, J. B., Esq., c. s. Chupra	1878
	Wyer, F., Esq., c., s., Bogra	1878
715	Wyatt, A. W. N., Esq., Bhukwa Factory, Dur- bhungah	1878
	Wright, W., Esq., Judge, Small Cause Court, Cuttack	1866

Y.

YOUNG, Lieut.-Col. Siddons	...	1871
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Z.

ZANDER LEO, Esq., Merchant, Calcutta...	...	1872
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Monthly Proceedings of the Society.

Wednesday, the 30th January, 1878.

THE HON'BLE LOUIS JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last meeting were read and confirmed.

The report from the Council was read and adopted.

The election of Officers and Council was next taken up and the following was the result --

President.—The Hon'ble Louis S. Jackson, C. I. E.

Vice-Presidents.—Mr. S. H. Robinson, Baboo Gogendro Nath Tagore, M. W. H. Cogswell, and Mr. W. Stallart:—

Secretary—Mr. A. H. Blechynden.

Council.—Mr. R. Blechynden, Baboo Peary Chand Mittra, Mr. E. Broughton, Mr. J. W. O'Keefe, Dr. S. Lynch, Mr. H. J. Leitch, Mr. G. L. Kemp, Babu Protapa Chandra Ghosa, Mr. E. Macneil, Dr. Geo. King, Dr. J. B. Barr and Mr. F. Eisenlohr.

Mr. Eisenlohr's name was added to the Silk Committee; the other Standing Committees need no strengthening, and remain, therefore, as in 1877.

The names of the following gentlemen were submitted as candidates for election:—

Edward Howard, Esq., Barrister-at-Law, Allahabad,—proposed by Mr. Eisenlohr, seconded by Mr. W. H. Cogswell.

W. E. DeSouza, Esq., Consul-General for Portugal,—proposed by Mr. Blechynden, seconded by the Secretary.

Rana Juggut Sing Bahadoor, Nepal,—proposed by the Secretary, seconded by Mr. Cogswell.

C. C. Masters, Esq., Barrister-at-Law, Bankipore,—proposed by Mr. Blechynden, seconded by the Secretary.

J. Heindricks, Esq., Merchant, Akyab,—proposed by Mr. W. F. Westfield, seconded by Mr. G. L. Kemp.

CONTRIBUTIONS.

1. Smithsonian Report for 1875. Ohio Agricultural Report for 1875. Report of the Commissioner of Agriculture, Washington, for 1875. Monthly Reports of the Department of Agriculture for 1875-76. From the Smithsonian Institution.

2. Annual Report of the Superintendent of Government Farms, Madras Presidency, for year ending 31st March. From Government of Madras.

Proceedings of the Society.

3. Records of the Geological Survey of India, Vol. X., Part 4, 1877. From the Government of Bengal.
4. Memoirs of the Geological Survey of India. Palaeontologia Indica, Ser. XI. 2. From the Director.
5. The Indian Forester, October 1877. From the Editor.
6. Forest Flora of British Burma, Vols. 1 & 2, by S. Kurz. From the Government of India.
7. Note on Tobacco culture and curing by E. Buck. From the Author.
8. Journal of the Asiatic Society of Bengal, Vol. XLVI. Part 1, No. 3, and Part 2, No. 3, and Proceedings for November 1877. From the Society.

GARDEN.

The Gardener's monthly report on the Garden at Alipore was submitted. "The work in the Garden has been the pruning and making cuttings of the Roses, which have been manured with the manure presented by Dr. Greenhill. The beds have since been well watered twice, and the roses are now in good flower, though not quite equal to last season's display." [A collection of some 40 kinds of cut roses was placed on the table including many favorite sorts.] "I am now clearing round and having the fruit trees manured. I have lately procured from the Suburban Municipality 20 cart loads of old cowdung, and hope to get more.

IMPORTED APPLES.

Mr. S. H. Robinson submitted a few apples from a hamper full he brought out in the *Khedive*. The large kind are known as the flat-nosed pippin, and the smaller as ribstone pippin in Devonshire, both being "keeping" or "store" apples there, and are kept through the winter months. Mr. Robinson adds—"I brought 60 in all packed lightly in the hamper, each in separate piece of paper, three days before we left Southampton on 13th December, and on opening them out here, six weeks afterwards, I found two only had decayed and four more were somewhat bruised, the rest all good and retaining their flavor fairly. They were in my cabin the first two weeks of the voyage, and for the rest of the time were kept cool in the ship's ice-room but not frozen.

"I think this experiment is interesting, as showing it is quite practicable to import English fruit apples for this market successfully; at any rate during our cold weather months, and without much trouble."

MANGOES RAISED OUT OF SEASON.

Mr. C. Gregory brought to notice the fact that in a small garden on the north of the dawk bungalow at Bankipore there is a tree which ripens its fruit in December. Mr. Gregory forwarded one of these at the end of December, apparently of Bombay stock, and of fine flavour. It would be interesting to learn if these trees are found in any other part of the country.

REANA LUXURIANS.

Letters, accompanied by packets of seeds, were read from Messrs. A. Christian of Monghyr, P. Duff of Ehaugulpore, and R. Nicholson of Mirzapore, regarding the above forage grass. Mr. Christian has found it to grow luxuriantly in the rains and is eaten greedily by cattle when green, but remains untouched by them when dry, that is, after the seed has been gathered. "I have not had much time to examine what the seed as a grain is fit for, but hope to do so in time; it is certainly an addition to our fodder crops and superior to the prickly comfrey which promised so much and has ended in utter failure." Mr. Duff states he has had 3½ seers of seed from three plants. "At this rate the grass will not be long in spreading over India. I intend sowing it largely next year. I have been asked by several friends for some of the seeds, and now think it will be generally cultivated for fodder for all cattle." Mr. Nicholson observes that the average height of his plants were upward of 10 feet and very bushy. "I think it is by far the best forage plant I have seen. I have numerous applications for seed, and will distribute as much as possible."

EXPERIMENTAL TEA CULTURE IN THE ANDAMANS.

Read a letter from Major Protheroe, Deputy Commissioner of the Andamans, returning thanks for the assistance rendered him in obtaining tea seed for trial in the Andamans. The Secretary mentioned that through the kind aid of Messrs Begg, Dunlop & Co., and Messrs. Williamson Magor & Co., he had been able to obtain good China, hybridized and indigenous seed. The latter (Naga Hill seed) had been obtained gratuitously through the intervention of the late Mr. P. S. Carnegie, the Commissioner of the Naga Hills, who had great difficulty in obtaining even so small a quantity as a maund in consequence of its scarcity the last season.

INSECT PESTS.

Letters were read from Messrs. Lloyd & Co., sending a box of diseased tea plant cuttings for report thereon; and from the Sub-divisional Officer, Burpeta, specimens of an insect term Bhoer which commits great depredations on mustard crops in Assam, and asking for a remedy.

COMMUNICATIONS ON VARIOUS SUBJECTS.

Letters were also submitted—

From the Director, Agriculture and Commerce, N. W. P., applying for Virginian tobacco seed for sowing in the Hills. Mr. Buck intimates that he has prepared a few acres to keep up a seed farm for supply of seed to the Plains. Request complied with.

From the Superintendent Government Gardens, Bangalore, applying for seed of the Bahmia cotton for trial of this new variety. Complied.

From Capt. H. B. Abbott, Political Superintendent of Jhallawar, requesting seed of *Reana luxurians* and mode of treatment. Complied.

From the Director, Oriental Museum, Vienna, requesting to be furnished with the publications of this Society, and offering to reciprocate. Agreed to.

From Dr. J. H. Ker Innes, Honorary Secretary, Simla Horticultural Society, applying for bronze medals for distribution at their periodical shows. Granted at cost price.

From A. R. Wallis, Esq., Department of Agriculture, Melbourne, returning thanks for a case of useful and ornamental plants.

From Baboo Peary Chand Mittra, a paper for the Journal on Bengal Rice.

From W. Knaggs, Esq., a paper on Tea Cultivation in Province Wellesley.

For the above communications and contributions the best thanks of the Society were accorded.

Thursday, the 21st March, 1878.

THE HON'BLE LOUIS S. JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last (January) meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. Edward Howard, W. E. DeSouza, C. C. Masters, J. Heindricks, and Bana Juggut Jung Bahadoor.

The names of the following gentlemen were submitted for election at next Meeting :—

Fred. Wyer, Esq., C. S., Bogra,—proposed by Dr. R. A. Barker, seconded by the President.

R. Turnbull, Esq., Secretary, Municipal Corporation,—proposed by the Secretary, seconded by Baboo P. C. Mittra.

Superintendent of the European Asylum, Bhowanipore,—proposed by Dr. S. Lynch, seconded by the President.

His Excellency General Sir F. P. Haines, G. C. B.,—proposed by the President, seconded by Mr. W. H. Cogswell.

The Hon'ble Justice H. S. Cunningham,—proposed by the President, seconded by Mr. S. H. Robinson.

R. S. Staunton, Esq., Calcutta,—proposed by Mr. R. Blechynden, seconded by Baboo P. C. Mittra.

The Mess Secretary, 44th N. L., Shillong,—proposed by the Secretary, seconded by the President.

G. E. Ward, Esq., C. S., Jaunpore,—proposed by Mr. C. Nickels, seconded by Dr. E. B. Gardner.

F. St. O. Grimwood, Esq., C. S., Sewan, Sarun,—proposed by Mr. C. W. Odling, seconded by the Secretary.

Proceedings of the Society.

J. Edgar Sherlock, Esq., Calcutta,—proposed by Mr. H. J. Leitch, seconded by Mr. G. L. Kemp.

M. David, Esq., Dacca,—proposed by the Secretary, seconded by Mr. Cogswell.

Mr. W. Waterfield was elected a Member of the Council in the room of Mr. H. J. Leitch, left India.

CONTRIBUTIONS.

Memoirs of the Geological Survey of India, *Palaeontologia Indica*, Ser. X. 3, and V 2. From the Superintendent.

Reports on the Royal Botanic Gardens, Calcutta, for 1876-77, and on the Government Cinchona plantation, for year ending March 1877. From the Superintendent.

Report on the Administration of Bengal, for 1876-77. From the Government.

Journal of the Asiatic Society of Bengal, Part 1, No. 4, 1877. From the Society.

Annual Report of the Smithsonian Institution for 1876. From the Institution.

A collection of acclimatized flower seeds. From H. E. Abbott, Esq.

A small assortment of seeds from Queensland. From the Acclimatisation Society.

A collection of Palm seeds from Director Royal Botanic Garden of Mauritius.

A few cobs of maize seed from Boolundshuhur. From the Director of Agriculture, N.-W. P.

A grape vine (with fruit on it,) from England; imported by the *Duke of Devonshire*, in excellent condition. From A. J. Milner, Esq.

FLOWER SHOW.

The following report of the Judges (Dr. G. King, Messrs. W. Stalkertt, E. Waterfield, G. L. Kemp, Dr. S. Lynch, and Colonel W. M. Lees) was submitted, in respect to the Show held in the Society's Garden, on the 2nd of March:—

The collection of plants brought forward on this occasion was on a limited scale, and the competition equally limited. There was a fair display of certain kinds of annuals, such as Phlox, Portulaca, Petunias, and Verbenas; also, though in less quantity, of Asters, Pinks, Heartsease, Snapdragon, &c. Of fine foliage plants there was a good collection, but principally from the Royal Botanic and Society's gardens; these were not introduced for competition, but to add to the interest of the show.

From the Royal Botanic Gardens came a collection consisting of *Adiantum Farleyense*, *Dendrobium aggregatum*, *Vanda gigantea*, *Phaius Wallichii*, *Dracena ferrea vera*, *Amargyllis* (various hybrids), *Equisetum Hookeri*, *Stapelias*, and a variety of Orchids, ferns and foliage plants.

The Society's garden contributed a large and varied collection, including, *Dracenas* (22 kinds), *Crotons* (24 kinds), *Anthurium* (8 kinds), *Diffenbachias*,

Proceedings of the Society.

(4 kinds), Palms (20 kinds), *Alocasia gigantea* and *hybrida*, *Aucuba Japonica*, *Pothos argyrea macrophylla*, *Salvia Japonica*, and *chionantha*; and large assortment of annuals, comprising *Verbenas*, *Phlox*, *Petunias*, *Heartsease*, and *Lobellias*.

The Solvadera Gardens contributed also several interesting plants, including Palms, Ferns, *Crotons*, *Dracænas*, *Aralias*, a few *Orchids*, and specimens of cut *Roses*.

In the class of fine foliage plants, Mr. C. J. Sutherland shewed the best collection (for competition) of 12 kinds, and the Eden Gardens the second best. The Auckland Garden submitted a fair collection of *Dracænas* and *Begonias*.

Camellias were poorly represented, and *Roses* still more so; but the season for the latter had passed away.

The gardener of Rajah Suttanund Ghosal obtained a prize from the sum (Rs. 50) placed at disposal of the Society by the President, for rare and well-grown plants, and for a very fine example of *Vanda gigantea*. Prizes were likewise given under this head for a *Phalaenopsis Schilleriana*, for *Lilium longifolium*, and for a small orange tree laden with fruit.

Mr. W. Stalkartt submitted for exhibition only some well-grown plants of *Araucaria Cookei* and *Rulei*; and the Hon'ble Mr. Justice Jackson some examples of *Pandanus* and *Crotons*, including a large and old plant of *C. Jacksoni*, the parent of the many since distributed.

A detailed list of the prizes awarded is hereto annexed.

There was a large attendance of visitors, Members and others.

The Judges beg, in conclusion, to recommend that the next show be held in the early part of February 1879, and that at least six months' notice be given.

GARDEN.

The Gardener's monthly report was next submitted, announcing the receipt of certain contributions, including palm seeds from Queensland, which have germinated well. The principal work has been the cleaning up of the garden to a certain extent and preparing beds for recently imported rose plants. The Gardener offers the following remarks in respect to Davidson's "Wheelhoe." "There was a trial here one morning of Davidson's "Wheelhoe," an invention for keeping Tea Gardens clear with economy of labour. The ground on which it was tried was very weedy and the instrument did not answer well, as it became clogged with weeds and rubbish; however sufficient was done to show that it would work on clean ground, and I think it is quite capable of doing all it was invented to do, viz., keeping ground clear by continually moving the surface with little labor, and for light soil it will perform that with little strength to propel it; but for heavy land it will require more than the strength of one cooly."

FLAX CULTIVATION FOR FIBRE.

The subject which next engaged attention had reference to the following letter from Mr. R. Macallister on cultivation of flax for the preparation of fibre :—

“ I submit herewith for the consideration of the Society samples of linseed straw and fibre worked therefrom. This flax was grown on the plantation of Mr. Lethbridge, Otter, Tirhoot.

“ No. 1 Straw is of last season's growth from Belgian seed, a fine long straw without branches; the average length is three feet. This sample is as fine as any I have ever seen in Europe or America. The sample of fibre marked A is the produce of a portion of the original sample of stalk sent me by Mr. Lethbridge. This fibre has only to-day, 12 months after growth, been taken from the straw by the rough process of a heavy jute softener; had the usual machine been available, the sample would have been much better. No. 2 straw of last year's growth also. This sample was grown on the same spot of land from the same seed as No. 1. The difference is owing to thin planting, the No. 1 is from thick sowing, whilst No. 2 is from thin sowing. Thin sowing in any country produces branches, straw, more wood in proportion to the fibre, and weak fibre. The fibre of sample B produced from No. 2 stalk, you will observe, is deficient in strength. No. 3 is a sample of this year's straw grown by Mr. Lethbridge from Belgian seed. This is a well-grown long straw, rich in fibre, of first-class quality. This sample has been plucked a little too early and not steeped long enough, as the sample of fibre accompanying (marked C) will testify.

“ These samples will be sufficient, I think, to show the Society what is likely to be the result of intelligent working amongst Indigo Planters and other Agriculturists, now that there is a local demand for the fibre.

“ I have not found time to go into the matter more particularly, but as we are now carrying out pretty extensive experiments at Deegah near Dinapore, under professional flax growers, we shall soon be able to lay before the Society more interesting details.

“ I enclose for the information of the Society three letters on the subject of flax, from persons in our employ, which we think may be interesting, as relating to their present experiences.”

The letter having been read, Mr. Macallister made several useful remarks regarding the various specimens on the table with reference to the mode of growth adopted and the consequent increase or decrease in strength of the fibre. Several of the Members present were favourably impressed with the strength of some of the specimens and its usefulness for local manufacture.

The letters referred to by Mr. Macallister were likewise submitted, of which the following are extracts :—

Mr. A. S. Patten, writing from Dinapore, observes :—

Proceedings of the Society.

"I was strongly advised by several planters to visit Sutamurhee as it was the centre of a large linseed-producing district. I determined to do so as I had already heard from natives that the seed was grown in small fields. I ordered palkee dāk to take us into Mr. Macgregor's factory at Doomrah, and arrived there the following morning. Mr. Macgregor very kindly drove us all round the country. I am of opinion that if the seed had been sown thickly instead of so sparingly that we should have had very little to complain of, as the stalk of course was weak owing to several branches growing from the same seed. This has been proved by Mr. Lethbridge who has produced a stalk quite as long and nearly as strong as that grown from Belgian seed. It will be for you to urge the Government to encourage the planters and natives to sow linseed from an imported seed instead of using the same seed year after year. The natives in Tirhoot appear to have a great opinion of manuring, and it only requires some management from the Government to produce as strong a fibre as in Europe and America as the heat in the latter is quite as great as in these districts. On Friday evening we returned to Bhicanpore where Mr. Swaine met us, and we drove to his factory Ottee. We examined the field and found the stalk had been pulled a little too soon. I repeated my offer to set and work off all stalk that he or Mr. Lethbridge would send me at Deegah, and promised to inform them of the result. On arriving at Ottee we met Mr. Lethbridge who told me that he had just received a letter from you and would despatch all stalk for me to set and scutch. We then started for the railway station at Mamuri and arrived at Barr on Sunday afternoon and remained there, as there was no train for Dinapore that night. We returned to head quarters yesterday morning.

"I am only waiting here as several natives have promised to bring in a quantity of stalk which I intend retting on the chur opposite the bungalow, as I am very anxious to prove that, although the native stalk is weak, we can still work at a profit by studying economy. I am sure that if you will import seed from Russia, say from Odessa or Tuganrog (the ripe seed is from a much colder climate) that we should be able to realise your first ideas as to the profits. I think that it would be a good plan for you to address all the zemindars in these districts, advising them to advance to their ryots seed purchased or exchanged from other districts, and that by cultivating their ground a little more and sowing more thickly that a far better return would be given, and a higher price would be paid for the stalk.

"You must not forget that this year has been particularly unfavorable one for growing linseed owing to the want of rain.

"Several planters have promised to send linseed so that I have great hopes our visit will not be without a good result, and that you will have a large supply of lint next year from this district."

Proceedings of the Society.

Mr. Crawley, writing from Dinapore, remarks:—

“Mr. Patten showed me your letter, asking me for my opinion about the prospects of the flax.

“We have visited a great many places since I came here, one place ‘Sina’ about ten miles from Arrah close to the Ganges appeared to me to produce a much better flax than any we had previously seen. I examined several samples, the straw is a good length fully as long as the green sample I saw in your office, the fibre is much stronger and has not that tendency to snap and tear short off the wood like most of the other samples. There is every facility for retting close by. I consider with proper care and close attention the flax could be worked in this district with considerable success. With regard to Tirhoot, Mr. Patten and myself have just returned from a four days’ run in it. I examined several specimens, but I did not like them. We called with Mr. Lethbridge, and here I found a change which confirms my opinion expressed to you that flax grown in the manner in which the ryots grow it will not answer; but that indigo planters and such like who have capital and can afford to sow it in rich soil that is well cultivated and well cleaned may grow it successfully. Mr. Lethbridge had a small field of flax sown with native seed in rich soil that was cultivated well cleared of all weeds and appeared to have been carefully attended to, he was just after pulling it. It is almost as long as the sample of Belgium flax which he sent you, stronger and much superior in every way to any native grown flax that I have seen. I thought it a pity to let him have the working of it as he knows nothing about it, so he is sending it and his Belgium flax down here where we will steep it and work it out.

“In about ten days we will be able to have it scutched, but I have not the smallest doubt as to the result being highly satisfactory.

“There are two other places, where we intend steeping some, but before giving my opinion I would prefer waiting till I see a parcel of the flax steeped and dried, when I will see how the fibre behaves. If it will scutch and cast the wood any way freely I don’t think you can lose anything in working a large parcel of it. It will however require economy and close supervision to leave a margin for profits.”

The best thanks of the Meeting were tendered to Mr. Macallister for his communication, for the inspection of the various specimens and for his promise of further details in due course.

In connection with the above the Secretary referred to the great interest the Society had always taken in flax culture, for the sake of its fibre, as evidenced in the numerous communications and reports which it had from time to time brought to the notice of the public during the past thirty-six years, through the medium of its journals and proceedings, commencing in 1840, when experimental cultivation was begun by a Member of the Society, Mr. Rogers, in the Burdwan

District, and carried on for sometime very perseveringly and at considerable expense. Then again by another member, Mr. Leyburn, in the Shahabad district; by Mr. Wallace at Monghyr; and subsequently, several years afterwards, by Mr. Cope in the Punjab. These, and various other experiments made at intervals, and published by the Society, are fully quoted in a report in 1873 to the Government of Bengal by Mr. W. H. D'Oyly, C. S. None of these numerous experiments resulted successfully in a commercial point of view, though the produce was, in many instances, favourably reported on, as it could not apparently compete in the home market with the produce of Europe. Flax, for fibre, cannot, it is feared, be profitably grown in Lower Bengal; now, however, that a local demand has arisen for it, and the attention of Indigo Planters and others has been attracted to its cultivation and preparation, there is a fair prospect of success attending the renewed endeavours that are being made for the growth, for its fibre, in Upper Bengal, of this useful and valuable product.

INTRODUCTION OF SILK WORM EGGS FROM JAPAN.

The Secretary, in submitting the following letter from Mr. G. DeCrestoforis of Jeagunge, stated that the subject had been brought to the notice of the Society some years ago, and several communications connected therewith published in the Journal. The Society had obtained a quantity of eggs for distribution, but the result was not successful, probably from the causes alluded to by Mr. DeCrestoforis.

"Aware of the interest which the subject of this letter may find with your Society, I think no better channel is offered to me than addressing you in order to obtain publicity and support to my proposition.

"It is well known how the cocoon crops of Bengal have since many years fallen off very considerably in quantity and quality, whether from the deterioration of the breed, from diseases or other causes. My notion is that an experiment should be made of rearing in this country the annual silk-worm of Japan, which gives a far superior produce than any of the Bengalee species. Experiments of the Japanese breed have already been made many years ago in this country but without success, and the reasons of this failure may be traced to many causes.

"The first and the most important is that silk-worm eggs of the annual species should go through a winter season before they can obtain maturity, and hatch properly. This was never done with the eggs that were years ago distributed in Bengal.

"There is also no certainty that such silk-worm eggs, as were sent at the time, were annual or bivoltine. Beside this, as far as I can remember, the Japan eggs were distributed too late in the season when the hot winds had already set in.

"As I have for the last five years gone out to Japan to buy silk-worm eggs for my constituents in Italy, and am now soon going back to Yokohama for the same motive, I would propose that a subscription for importing annual Japan cards in India should be opened here, and I would undertake to buy them and forward them so as to be out here on about the end of November next.

"The cards on arrival here should be sent at once to the North, where they might be kept two months or more at a regular temperature of about 20 to 25 degrees of Fahrenheit beginning, if possible, at 35 degrees, and gradually lowering for the first ten days; and afterwards brought down in Bengal for distribution amongst the natives, the cocoon rearsers of the different silk districts.

"In my opinion the best time for hatching them would be on about the end of February. From the produce experiments may be made to improve the Bengal species by cross-breeding them with the Japanese, or fresh importations of eggs from Japan may easily be procured every year. The cost of a card delivered here would average from 3 to 6 Rupees, and a card can produce close to a maund of cocoons, which, for their superior quality, would be worth double the price of the Bengal cocoon, taking also into consideration the better class of silk that can be obtained.

"If this proposition will meet the favor of the Government of India on behalf of the impossible native cocoon rearsers, and the favor of the silk manufacturers of Bengal, particularly if your Society will second my views, and give publicity to them, I doubt not that a great change for the better will be obtained for the sericulture of this country.

"If requested, I shall be glad to give any further particulars as regard the terms on which I propose that the business should be carried on."

PROPOSED EXTENDED UTILIZATION OF THE SINGHARA NUT.

Some further interesting particulars on the above important subject were submitted by Captain J. F. Pogson, in continuation of those which were laid before the general Meeting in December last:—

I send—writes Capt. Pogson—for utilization and publication in the Society's proceedings, a second paper on Singhara cultivation [from the *Delhi Gazette*.] The sound, simple and practical measures suggested by me may or may not be adopted.

"But as the Indian Authorities may under pressure from England have to expend several millions sterling on water-works, and to store water for use when the rains fail, the information I am about to give might be utilised, and so prevent the State from suffering considerable pecuniary loss during those years, when the rains are regular and plentiful, and the Ryot and Zemindar declines to use canal or lake water for his crops.

"The Chinese are a rice-eating nation. But being well instructed in agricultural matters they extensively cultivate the "*Ling*" (Chinese for the *Tropa*

bicornis) which with them forms an important article of food, and has done so from time immemorial.

"It is highly probable that the first food-producing plant, cultivated by man after the Deluge, and before the soil had been sufficiently sweetened to grow rice, wheat, and other cereals, was the *Trapa natans*. That it was cultivated in Europe in ancient times will be admitted when it is known, that 'They have been recently discovered in a very perfect state of preservation amongst many other vegetable products in the ancient lake habitations of Switzerland.'

"Pliny, who wrote on the subject some eighteen hundred years ago, states 'that the Thracians made bread of them,' and as the modern inhabitants of many districts in Southern Europe to this day convert the kernels of the dried nuts (*Trapa natans*) into meal, and with it, after suitable manipulation, 'make and bake very good bread, the value of the *Marron d'eau*, or water chestnuts of France, and the 'Jesuit's nuts' of Venice, may be considered as fully and fairly established. The Chinese species (*Trapa bicornis*) is provided with two horns, whilst the far superior Indian species, *Trapa bispinosa*, is provided with two formidable thorns, which protect its large kernels from being devoured by wild animals.

"Mr. John E. Jackson in his paper on '*Curious Forms of Fruits*' states in reference to the water-nuts, that 'All the species are floating water plants; they have long jointed root stocks, and the roots themselves are very fine and hair-like. The leaves are triangular, dentate or toothed, and are arranged in a cluster, while the stalks are buoyant, and help to float the leaves. *Trapa natans* is a native of the South of Europe, and grows in stagnant or slow running waters.' The *Singhara* of India flourishes in the lakes of Cashmeer, and also in ordinary tanks all over the upper Provinces and Bengal. The owners of tanks, under 'Singhara' culture, derive a very handsome annual income from their property, to prevent the extension of this profitable cultivation they have caused European enquirers to believe that the shortest way to fill up an extant tank (irrespective of its size and depth of water,) is to plant it with water-nuts. The *Indian Traveller*, quoted by Mr. Jackson as an authority states, 'The people are very fond of these nuts. They ripen in the latter end of the rains or in September, and are eatable till the end of November. But the mud increases so rapidly from this cultivation, that it soon destroys all reservoirs in which it is permitted, and when it is thought desirable to keep up the tank for the sake of the water it should be carefully prohibited. It (*Singhara*) is cultivated by a class of men called Dheemurs who are every where fishermen, and palankeen bearers, and they keep boats for the planting, weeding and gathering of the *Singhara*.' The absurdity of an aquatic plant with fine hair-like roots, inducing the production of mud, is apparent, and the fiction is at once knocked on the head, by the fact of boats and 'Ghurrah' floats being used to carry on the cultivation in the same locality from year to year.

"The jheels and tanks in which the Singhara is grown, almost as a rule, contain some sort of fish, and these are netted either by the leassee for their own benefit, or else for that of the proprietor, who remunerates them for their labour.

"The palkee-bearers of Bengal Proper, Oudh, N.-W. Provinces, and other parts of the country are not only agriculturists, but load-carriers. The *banghy* of the *kahar* requires no explanation. With it he carries the traveller's *pittoras*, or when occasion requires, cowdung cake fuel, mangoes, fish and Singharas. He is a proficient in the art of making net-work, of twine, stout string or half inch rope. If fish are to be had in his neighbourhood for the catching, a cotton string net with mesh of suitable size, is soon forthcoming, and he increases his income by catching and selling the fish. The genuine fisherman by caste and hereditary avocation is called a *mutchwa*, a term never applied to the *kahar*, who when enlisted makes a brave and gallant sepoy, and when utilised as a camp-follower, carries hospital *doctees* under fire, and the sick to hospital in cantonments. Of all the castes of Hindoos, the *kahar* is the most useful and easily managed. He will serve in any part of Hindoostan, and, if the project of systematic *Singhara* cultivation is carried out, the employment of *kahars* as workmen and practical instructors will have to be adopted.

"The great difficulty the Government of India has to contend with is not so much Famine as the habits and customs of the population. In Bengal Proper and Madras the people live upon boiled rice, and decline to use leavend or unleavend maize, millet or wheat bread. In the Punjab rice from Bengal would be of little use in relieving a famine, for without wheat and millet bread as a standby the stalwart Punjabee would lose flesh and muscle and suffer from innutrition. In the Himalayas maize meal bread is the daily food of the labouring and agricultural classes, boiled rice with sugar and *ghee* or *dall* is for high days and feasts of honour, and not for hard hill work which the rice-eating Bengallee could no more undertake than a Thibetian goat could carry the load of a mule. The good folks of England have been greatly puzzled at India exporting immense quantities of wheat *via* the Suez Canal, whilst a famine was raging in the Presidency of Madras, and they would no doubt be quite bewildered, if Bengal and Madras sent shiploads of rice to the United Kingdom, during the prevalence of a famine in the North-Western Provinces and Oudh.

"The explanation given is intended to convey to the mind of the British public that there is always an ample supply of food grains in Hindoostan. But that if millions will starve rather than eat bread, and others languish if placed on rice the consequences rest not on the Government but the people.

"That India will suffer from future Famines is more than probable, and I venture to submit that with the exception of the *Singhara*, there is no other food crop available to meet our wants.

"The rice-eating millions of Bengal and Madras will eat these tasty and nutritious nuts with pleasure if they be available, and the bread-eating millions will do the same. The beds and bottoms of lakes, jheels, inland fresh water seas, and *vast reservoirs yet to be made* have only to be planted or sown with the matured nuts, to bear immense crops on the water's surface, and as the harvest or season lasts for three months, starvation from famine ceases to be a menace; finally, as the dried nuts will keep good for years, and may be easily stored, the maximum of surplus and extra wholesome food, is secured at the minimum of cost."

In a subsequent letter of 31st March, Captain Pogson adds as follows :—

"Your kind letter of the 9th instant reached me yesterday, and I am very glad to learn therefrom, that the further information on Singhara culture is considered of use and value. [This refers to an application from the Editor of the *Provincial Gazetteer*, N.-W. P., for a copy of Captain Pogson's previous paper.]

"I only hope that in place of paper war and work, ending in nothing, the Government of India will look upon Singhara cultivation as an Imperial measure directly connected with Finance, and prevention of Famine, and act accordingly.

"If the present season for sowing the nuts is allowed to pass, without the formation of nursery plantations, not only will a year be lost, but a tidy round sum of money will have to be paid for seed nuts to be purchased from the zemindars in 1879.

"I hope my language has been sufficiently clear, to make the obstructive reader understand, that every square mile of water surface, if covered with Singhara, represents 640 acres of food-producing area, which will yield saleable produce for three months and in no ways interfere with irrigation, should the ryot, under pressure of drought, decide on using the water accumulated at great cost for his benefit.

"If this was well and widely known, the Madras Revenue Authorities might soon become converts to our views, and the introduction of the water-nut would follow. The Government must make up its mind to bear the cost of producing additional revenue without resorting to taxation, and the water-nut project properly carried out, will very soon get them (Government) out of Financial difficulties.

"We should bear in mind that the sundried nuts, (kernels) if put up in sacks and sent to Europe, would meet with immediate and remunerative sale, and as they will keep in their tough outerskins for years, all we have to do is to find out some chemical solution which, when absorbed by the skin, will prevent white ants and rats and mice from attacking them. When this is accomplished, the nuts may be kept in pits for years. I will in due course go into this matter, and report progress for publication.

"I am greatly obliged for your offer of vegetable seeds; all you can spare will be very acceptable. American Maize is of great value; and through my good friends the Missionaries, even the people of 'Lahou' in Little Thibet will this year see for the first time cobs of Maize, the produce of seeds received from you, acclimatized by me, and then given to the Missionaries. In like manner, Beans have been distributed, and at Kotegurh, the Sylhet bean first sent you by Mr. Hudson, and on to me, grows most vigorously, and yields abundantly."

"If available, I should like to have one seer of 'Beana luxurians' seed, as it will be a boon to the Hill men. Yesterday dry hill grass was selling at fourteen annas a maund!!"

HORTICULTURAL NOTES.

In his letter of advice of despatch of the collection of acclimatized flower seeds previously referred to, Mr. H. E. Abbott of Jaintpore, Tirhoot, writes:—"These are all I can send you this year worth having, though later on I shall have some very fine *Portulaca* seed for you. My balsams this year were not fine, the want of rain affecting them much, and I shall be glad to obtain a fresh lot from you. The seeds sent last year by the Society afforded me great satisfaction, scarcely anything failing. Messrs. Buist's collections (American) are always good. Vilmoren Andrieux (French) are generally to be depended on."

"My Sweeds and Mangal Worzel although very fine do not come up to last year for two reasons: first, the deficiency of rain, and secondly, that during my absence in Calcutta, my clever jamadar sowed them in exactly the same field as that of last year. Hence as is but natural they are not equal in size to the monster specimens of last year; still the success is undoubted, and I hope the Government will be induced to import a quantity of seed and offer it to the ryot at reduced rates; its chief advantage being the root being procurable at a time of year where there is little or no other green food available for the cattle."

Wednesday, the 22nd May, 1878.

THE HON'BLE LOUIS S. JACKSON, C.I.E., *President, in the Chair.*

The proceedings of the last (March) meeting were read and confirmed.

The following gentlemen were elected Members:—

His Excellency General Sir F. P. Haines, G.C.B., the Hon'ble Justice H. S. Cunningham, Messrs. F. Wyer, C. S., R. Turnbull, R. S. Staunton, G. E. Ward, C. S., F. St. C. Grimwood, C. S., J. E. Sherlock, M. David, Superintendent of the European Asylum, Bhownipore, and the Mess Secretary, 44th N. I., Shillong.

The names of the following gentlemen were submitted for election at next meeting:—

F. T. Reed, Esq., Hetampore, Beerbhoom,—proposed by the Secretary, seconded by Mr. W. Stalkartt.

H. A. Adkin, Esq., Solicitor, Calcutta,—proposed by Mr. S. H. Robinson, seconded by Mr. W. H. Cogswell.

Dr. W. E. Battersby, Superintendent Central Jail, Bhaugulpore,—proposed by Dr. Geo. King, seconded by Mr. W. Stalkartt.

J. M. Darwood, Esq., Rangoon,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

E. Drouin, Esq., Acting Consul General for France,—proposed by the President, seconded by Mr. Cogswell.

Manager Muttuk Tea Company, Assam,—proposed by the Secretary, seconded by Mr. Robinson.

Captain C. J. Wilkinson, Superintendent P. and O. Co.,—proposed by Mr. H. B. H. Turner, seconded by Mr. Cogswell.

Major R. F. Angelo, B. S. C., Commanding at Chunar,—proposed by Colonel W. Siddons Young, seconded by Mr. W. Waterfield.

Manager Hoolungurree Tea Co., Assam,—proposed by the Secretary, seconded by Dr. Lynch.

Secretary Municipality of Mau, Ranipur, Jhansi,—proposed by Dr. J. P. Stratton, seconded by Mr. Waterfield.

C. S. Kirkpatrick, Esq., the College, Delhi,—proposed by Mr. F. Halsey, seconded by Mr. Alex. Skiuner.

Manager of the Tukvar Tea Company,—proposed by the Secretary, seconded by Mr. Robinson.

Baboo Rajendronauth Mookerjee, Calcutta,—proposed by Baboo P. C. Mittra, seconded by Baboo G. N. Tagore.

Manager of the Phoenix Tea Company, Cachar,—proposed by Dr. J. B. Barry, seconded by the Secretary.

Rejoined—Charles Chambers, Esq., Calcutta, and W. M. Smith, Esq., Deputy Settlement Officer, Sonthal Pergunnahs.

CONTRIBUTIONS.

1. *Fragments Phytographiæ Australiæ*, Vol. X. By the Baron Ferd. von Mueller. From the Author.

2. Report of Commissioners for 1876 of the Department of Agriculture, Washington. From the Commissioners.

3. Catalogue of specimens of Timber for the Paris Exhibition of 1878. From the Government of India.

4. Progress of Reports of Forest Administration for 1876-77 in British Burmah, in the Punjab, and N.-W. P. From the Government of India.

5. *The Indian Forester*, No. 3, Vol. 3. From the Editor.

6. *Journal of the Bombay Branch Royal Asiatic Society* for 1877, No. 35, Vol. 13. From the Society.

Proceedings of the Society

7. Journal Asiatic Society of Bengal, Part 2, No. 4 for 1877, and Proceedings, December 1877 to March 1878. From the Society.

8. Report of the Committee of the Bengal Chamber of Commerce, May to October 1877. From the Chamber.

9. Seed of a gigantic fodder grass *Festuca dives*, which thrives in humid vallies of forests. From the Baron Ferd. von Mueller.

10. A small quantity of Guinea grass seed. From W. B. Carshore, Esq.

11. An assortment (82 kinds) of Bangalore acclimatised flower seeds. From the Superintendent of the Royal Botanic Garden, Bangalore.

12. Four seeds of *Amherstia nobilis* from Moulmein. From Major R. W. H. Fanshawe.

13. Roots of Primrose from Mezufferpore, Tirhoot. From T. M. Francis, Esq.

The Gardener reports that the *Amherstia* seeds rotted as soon as put out into moist earth, and that the Primrose roots died shortly after arrival.

GARDEN.

The Gardener's monthly report was submitted. A pipe drain has been laid down from the entrance tank to the nursery to economise labour in future in watering:—"The new roses have been planted in the beds prepared for them, and the duplicates potted into larger pots. I have also planted out such other of the new plants to grow on for stock in position calculated to suit them, and stock will be quicker produced thereby than in pots. I have likewise planted out two beds of Palms of common kinds: there are three other beds left, but as the stock of better class of Palms is very limited, I thought it better to leave them for the rainy season, when there will be a better chance of their succeeding with less injury, &c. A great quantity of Crotons I have planted out into beds, freeing a quantity of pots; these can be repotted at end of rains and disposed of; thus they will by that time be good size plants. A quantity have also been put into larger pots, and are now nice plants in all sizes from 6 inches to 2 feet high, bushy, &c. The general distribution stock is now vastly superior to what it has previously been and less of the very common stuff, and I have nearly prepared every thing necessary to render the giving over charge to a successor easily."

BAMIA COTTON.

Reports, with specimens, from the Cawnpore Experimental Farm, Mr. W. Masters of Hajeeopore, and the Secretary, on the result of trials with the Bamia cotton, from seed presented in June last year by Mr. J. C. Chapman of Alexandria, were next submitted, together with a favorable report by Messrs. W. H. Harworth & Co. on the specimens. The Secretary stated he had incorporated all this information in the form of a paper, which was transferred for publication in the Journal. The Secretary also intimated he had requested a further supply of seed

from Mr. Chapman to supplement the small quantity of acclimatised seed in stock, though judging from some remarks in a recent letter of the *Times* Alexandria correspondent it seemed doubtful if such seed could now be relied on. "The way in which the seed is mixed," observes the writer, "is admirably illustrated by the recent experiments made in the Bamia cotton plant, which was to revolutionize the cotton market by its productiveness and quality." The seed ran up to 10, 20, and even 30 times the price per ardeb of the ordinary seed. This was too much for the sellers. In every case there was adulteration, and no experiment has proved decisive on account of the admixture of other qualities."

BEANA LUXURIANS.

The Secretary reported the receipt, in continuation of those announced at previous meetings, of applications for seed of *Beana luxurians* from the Government of the Punjab for the Superintending Engineers, Bari Doab and Western Jumna Canals; from the Agent Governor-General, Baroda, for trial on His Highness the Gaekwar's territories; from the Superintendent Horticultural Gardens at Lucknow; from the Superintendent of the Lall Bagh, Bangalore, and others; about two hundred packets of seed acclimatised in the Society's garden, had already been distributed throughout the country, and applications were still coming in daily. He also submitted a translation of a paper on the subject, which has appeared in a recent number of the monthly proceedings of the Acclimatisation Society of Paris, as likely to be useful to those who are interested in the spread of this valuable fodder grass which has now been so successfully introduced solely through the exertions of this Society. (Transferred for Journal).

SILK.

The subject next submitted had reference to the proposed introduction of sericulture in the canal banks in Orissa. Mr. D. B. Horn, Assistant Secretary, Government of Bengal, P. W. D., submits communications on the subject from the Superintending Engineer, Orissa Circle, and the Executive Engineer Mahanadi Division, describing the result of some experiments made by Mr. Atkinson, Supervisor, on the rearing of silk-worms and the silk obtainable from the cocoons. "The subject is one," observes the Chief Engineer, "on which I can offer no opinion; but as Government has now under consideration certain proposals for planting trees on the spare lands adjoining our canals and distributaries, perhaps you may deem it worth while to have the opinion of some experts on the quality of the enclosed silk, so that a proportion of land available may be reserved, if considered advisable, for the cultivation of Mulberry." Messrs. J. Thomas & Co. had kindly reported on the cocoons and raw silk, and the report is altogether favourable so far as the small quantity would enable them to judge. The Secretary added he had replied, to the best of his ability, to the other queries in Mr. Horn's letter.

REMARKS ON THE TREATMENT OF SILK-WORMS.

In connection with the above, and to the communication from Mr. DeCristoforis in the proceedings of the last meeting, the Secretary submitted the following remarks from Mr. C. E. Blechynden in reference to the present mode of rearing silk-worms :—

“ I see in the Society’s report in to-day’s *Englishman* a communication from Mr. DeCristoforis regarding the introduction of silk-worm eggs from Japan, and animadverting on the degenerated stock of the worms now reared in Bengal.

“ Is it to be assumed that the mere introduction of a superior and healthier breed of worms would do away with degeneracy of the worms of the country because the cause of degeneracy is not touched on. Is it merely to be ascribed to a wearing away of vital powers. Then it is to be asked what has caused the depression, and would not the imported worms in course of time be equally affected. Perhaps Mr. DeCristoforis means that eggs should be imported each year, but who are the parties that would take advantage of Mr. DeC.’s offer to carry out such a plan ? I am not aware of any Europeans being engaged in sericulture in Bengal, natives alone follow the occupation. Would it not then be better at first to look at their mode of rearing and see if no reform could be introduced that would raise the vital powers of the worms now existing, than to follow the plan of getting fresh eggs each year from Japan. Natives are highly conservative, and have a keen regard as to the outgoings of their money ; once in the way a native may be induced to buy a card of eggs, but it will be a long time before he incurs a second outlay for the same purpose, at least not till the imported worms have degenerated down to those of the country ; so that the proposed plan for fresh eggs has only a temporary effect, as the cause of degeneracy remains untouched : it is here that efforts at improvement should be made.

“ Look at sugar-cane, cotton, tobacco, Carolina paddy, how has good seed and bad culture ended in failure ; so it will be with the silk-worm. It is the plan followed in rearing that does all the mischief : the breeds of worms of the country being acclimatised are quite capable by proper breeding of giving returns fully equal to Japan or Italy.

“ I beg to refer you to my remarks published in the Society’s Journal in 1858 as regards Mr. Bashford’s experiments in cross-breeding with Europa silk-worms.

“ I would undertake in one year to produce cocoons from the Bengal worm that would stand comparison with cocoons reared in Japan.”

In a subsequent communication the subject is continued as follows :—

“ About silk-worms, I agree with you that the infusion of fresh blood (so to call it) into the present decrepit breed of insects reared in this country would be a gain, but only so far as it would save time by reviving the failing powers

of the Bengal insect, provided a new leaf were turned over as to the mode of rearing. But what I argue is that all efforts to improve the culture of a better description of insects, vegetables, or plants, by fresh importation, would be and would have been in vain, unless the foundations are and had been materially altered, or in other words a more rational and better suited plan adopted. In the case of vegetables, can we say that the simple fact of fresh importation of seeds has alone been the cause of improvement, or has a better mode of culture?

"I write with a full knowledge of my subject, having for years studied all the minutiae of rearing as followed by natives. In my own experiments, I have, by totally discarding all their palpable errors, succeeded in producing (*without imported insects*) a breed of worms that gave results in silk of a superior quality, the yield being twice as great as that given by the same breed of worms in the hands of native rearers."

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following papers were also submitted:—

From J. E. O'Connor, Esq., presenting notes on a new fibrous yielding plant (*Malachra capitata*.)

From Col W. H. Lowther, forwarding certain papers for "Gardener's note Book"—(1) on Indian Culinary vegetables; (2) on Indian Vegetables; (3) on the culture of Leeks; (4) on cheap hand glasses and their improvements; (5) notes on Flower gardening.

From Capt J. F. Pogson, suggestions for guarding against the consequences of droughts in the future.

From F. R. Tottenham, Esq., on extensive planting of trees throughout the country to aid in reducing famines in future.

The above were transferred for publication in the Journal.

From O. Wood, Esq., Deputy Commissioner, Rohtuk, applying for information regarding the cultivation of the earth nut (*Arachis hypogea*) Complied with.

From J. P. Stratton, Esq., seeking information respecting the "Mesquit Bean." Complied with.

From Messrs. Duncan Brothers, requesting particulars (with reference to Capt. Pogson's communication on the subject in the last published proceedings of the Society) on the cultivation of the water nut (*Trapa bispinosa*) on behalf of a correspondent in Cachar who has means of carrying it out on a large scale. Complied with.

From Messrs. Geo. Henderson & Co., applying on behalf of Mr. M. David of Dacca, for the loan of a Cotton Saw Gin. The Secretary reported that he had transferred the Gin from Messrs. Bates, Hyde & Co. of Massachusetts, which competed successfully many years ago for the prize offered by the Government of India through the Society, on the understanding that Mr. David favours the Society, in due course, with the results of his trial.

Proceedings of the Society.

For the above contributions and communications the best thanks of the Society were accorded.

Thursday, the 27th June, 1878.

THE HON'BLE LOUIS B. JACKSON, C.I.E., *President, in 'ho Chair.*

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members.

Messrs F. T. Reed, H. A. Adkin, J. M. Darwood, C. S. Kirkpatrick, E. Drouin, Dr. M. E. Battersby, Manager Mutuck Tea Company, Capt. C. J. Wilkinson, Major R. F. Angelo, Manager Hoolungurree Tea Company, Assam, Secretary Municipality of Mau, Manager of the Tukvar Tea Company, Baboo Rajendronath Mookerjee, and Manager of the Phoenix Tea Company, Cachar.

Mr. George Takeda, of the Interior Department, Japan, was proposed a Member; and the names of Lieut. Henry Grey, Ranchi, and Dr. C. Prentis, Goruckpore, were submitted as having rejoined.

The Hon'ble the President announced a donation from His Excellency the Viceroy, (Patron of the Society) of Rs. 500, and put in for record the following extract of a letter on the subject to his address from the Private Secretary:—

“His Excellency has much pleasure in giving the Agricultural and Horticultural Society a donation of Rs. 500, for which I enclose cheque herewith, and regret that it escaped his memory at the time he accepted the position of Patron.”

CONTRIBUTIONS.

1. Report on the experimental culture of the Opium Poppy for season 1876-77. By John Scott. From the Government of Bengal.

2. The Indian Forester, Vol. III, No. 4. From the Editor.

3. Journal of the Asiatic Society of Bengal, Part 2, No. 1, 1878, and Proceedings for April and May 1878. From the Society.

4. A further supply (12 pounds) of Bamia (Egyptian) cotton seed. From Mr. J. C. Chapman, Alexandria.

Mr. Chapman mentions that this seed is genuine, though it is difficult to procure now, unadulterated, being generally mixed with Ashmouni, and sells for £ 30 the Runtar. “Here,” adds Mr. Chapman, “the Bamia plant is mostly a failure, requiring an immense deal of water, and growing too tall, as high as 18 feet.”

This seed is available to Members desirous of trying this new kind of cotton.

5. A packet of Mahogany seed from Jamaica. From Dr. G. King. (Transferred to Garden.)

[Since the meeting a further large quantity of seed of this valuable tree has been presented by Dr. King, with the following directions for sowing:—“Put the seeds into the soil so that the broad thick end of each seed shall be lower-

most and let only this part be covered, leaving the thin end sticking out of and uncovered by the soil. Keep in a shady place under cover, and water gently. Transplant the seedlings into pots when three or four inches high."

[This seed is available for Members.]

6. Seeds of *Terminalia melanocarpa* and *Delabechia rupestris*. From the Queensland Acclimatisation Society. Mr. Barnays states that the first-named tree affords a beautiful shade, the second is their curious "bottle tree."

7. A small quantity of Indian Corn raised in the Beelundshuhur district. From the Director Department of Agriculture, N. W. P.

8. A small quantity of acclimatised seeds. From Dr. O'Brien of Roomaree in the Debrooghur district.

The following is extract of Dr. O'Brien's letter to Messrs. Balmer Lawrie & Co., dated 24th May:—

"I am sending down a parcel of seed for the Agri-Horticultural Society, which I shall feel obliged by your making over to the Secretary. The seeds are those of the *Reana luxurians*, Cauliflower, Indian Pink, and Convolvulus.

"Last year I got a very small quantity of the *Reana luxurians* seed, a few of which germinated, and from these plants I got a large quantity of seed last cold season. I have distributed some in the district to a few of my friends. I think it is a very valuable fodder for cattle, and will pay us to grow. I have planted out six to eight acres of land with it for our cattle.

"The cauliflowers from which I saved this seed were some magnificent ones I raised from seed I had saved the year before. These cauliflowers were much superior to those got from imported seed, and if properly treated with plenty of manure ought to produce superior flowers next season.

"*Eucalyptus globulus*—About 3½ years ago you sent me up some of this seed, from which I got a large number of plants. They grew so vigorously during the first year that I became certain they would succeed here. I was however mistaken, nearly all have died out, and now I have only two plants left. Both very seedy looking, and which I expect will die during the current rainy season.

"The *Eucalyptus rostrata*, however, seems to me will thrive here. I have plants now over eighteen months in the ground and none show any signs of decaying. Some are from eight to twenty feet high, but very slim and require to be kept propped up to prevent them tumbling about.

"The flower seeds are from plant raised from seed supplied by the Society."

9. A fine healthy plant of the "Cannon ball tree," *Couropita Guianensis*. From Mr. R. M. Daly, on behalf of the Superintendent of the Botanic Garden, Pondicherry.

10. A quantity of Sunflower seed. From Mr. F. Halsey.

GARDEN.

The following memorandum from the Gardener regarding the bone-dust and powdered castor-cake which were presented in September last by Mr. Greenhill of Messrs. Cook & Co., was submitted:—

Proceedings of the Society.

"These manures were used with cabbage, cauliflower and tomatoes, roses and annuals, and the result shewed that the bone manure was beneficial, but the castor had no manured effect; both were used in the same proportions. There was something in the castor that had an injurious effect on foliage when exposed to the sun. The beds of roses, manured with bone, is now much in advance of the others."

UTILIZATION OF CERTAIN PLANTS IN TIMES OF SCARCITY.

The following letter on the above subject from Capt. J. F. Pogson was next recorded :—

"I have this morning been overhauling my collection of seeds and papers, and enclose a small parcel of seeds, of a plant quite unknown to me; but which from its appearance, peculiar growth, and form of seed pods I look upon as a fibre-producer. [These seeds belong to a *Crotalaria*; they have been sown in the Garden.]

"The dried flowers and leaves were preserved, but owing to my three moves, they are *non est inventus*. The flowers are magnificent like very large sweet peas, color deep gold. Scent very agreeable, and partaking of the Heliotrope and sweet Babool, (*Acacia Farnesiana*.) They grow in spikes like the common 'Saim' of Bengal.

"I wanted a lot of convolvulus seed for covering an unsightly sloping bank, or hill cutting. On inspecting the seed procured from the bazar I noticed some very curious ones, and had them all picked out and sorted. All were sown, some did not germinate, but the kind under notice came up in some places. It was allowed to grow, attained a height of from three to eight feet, single thin stems, with flower spikes. The seed pods were like peapods, from 1½ to 2 inches in length. When ripe, the seeds rattled in the pod on the stem being shaken. The seed pod of the 'Sun,' resembles one of these seed pods on the large scale.

"I should like the seeds to be cultivated to ascertain what the plant really is. [The plants raised from this seed are *Crotalaria juncea*.] The soil should be limed before sowing which may take place on receipt. I have kept sufficient seed for my own sowing, and if the plant proves to be a fibre-producer, its value is evident; if not, we have a beautiful garden flower. On looking over my notes I find amongst those of 1874 one which is likely to prove of very great value to India at all times, and especially so when famine is to be the order of the day.

"I enclose a copy of the note for submission to the Council of the Agri.-Horticultural Society of India, in view to action being taken in the matter if thought fit. In a case of such importance, State aid should be forthcoming in the shape of cash. If referred to the Secretary of State, London, it may take two or three years to obtain the seed and some young plants; whereas the Society could procure both in six months.

"The Babool, (*Acacia Farnesiana*) and Keekur, (*Acacia Catechu*) are now in pod and will ripen seed in all May. The seeds are produced in very considerable quantities, and are wasted. In 1878, whilst at Umballa, I operated on some seeds of seed, and after giving them a good long boil I was much pleased to find that the very hard seed under the action of hot water boiled quite tender, and was fit for use as cattle food.

"The pods of both kinds, before the seeds ripen and harden, are freely used by goatherds and cowherds, as cattle food. But the ripe pods are neglected and allowed to rot. The dry pods (i. e. the shells) contain a large proportion of tannin, and will tan skins, and make ink and brown dye, with sulphate of copper. This letter is written with ink, made from 'Keekur' pods, and sulphate of iron. It struck me, that if the pods and seed could be eaten by cattle in their immature state, that the ripe seed could not be devoid of value as cattle food, if the hardness of the seed could be got over. The experiment followed. But as I had neither goat nor cow, the boiled seeds were thrown away.

"I dare say soaking them till about to sprout would answer as well as boiling."

The following is the note alluded to by Capt. Pogson. The Candle tree was introduced into the Royal Botanic Garden some years ago, but has not yet seeded:—

"CANDLE TREE.—*Parmentiera cereifera*, (Seem) *Palo de velas*, or *Candle tree*, Valley of the Chagres, South America.

"This tree has received the above name in consequence of the similarity which its fruit bears to a candle. The fruit has an apple-like odour, and is used for feeding cattle, for which purpose it is of great value, being produced in its greatest abundance during the dry season, when vegetation is all destroyed by the sun."

In connection with the above a communication as follows, from Mr. F. R. Tottenham, was next submitted:—

"Every one has heard a great deal about the famine in this country, and that a very large sum of money has been received from England and other countries to help the poor unfortunate people. Also that there is a Commission appointed to enquire into the best method of preventing similar occurrences. Railways and Canals also have their advocates. I believe that both are equally useful, but would confine the latter altogether to Irrigation instead of trying to compete with Railways.

"Permit me to suggest to the Commission the advisability of Government holding out a reward for extensive planting of trees throughout the country.

"In Canada the climate has of late years been so dry since the wholesale destruction of the fine forests there, that a general outcry has been raised about the want of rain. The Government have found it expedient to have enquiry set on foot respecting the reasons for the want of rain, and have lately held out

rewards for the planting of trees through the country generally, and particularly so on the sides of the roads, giving the owners of the ground exclusive rights to all trees planted there by them, and making it punishable for any one to damage any such tree.

"The Agricultural Societies in every county and township also hold out rewards and prizes for the farm on which the greatest number of trees are planted. I should think that some such arrangements might be carried out in India, and believing it would confer a lasting benefit to the country in general, have induced me to trouble you with the suggestions.

"P. S.—I may also say that our rule respecting blight, &c., in grain is to blow our seed grain quickly through our Fanning Mills, to get rid of all light imperfect grains which causes smut, &c., and when well cleaned to wash our seed grain with water in which a strong solution of salt and some bluestone is poured: by following this method farmers will soon reap the benefit at a very small cost. The saltwater to be effective must be strong enough to float an egg."

Letters were read:—

From Director Department of Agriculture, N. W. P:—

First.—Applying for seeds and for further information regarding the fibre-yielding plant, "*Malachra capitata*." Reference suggested to Bombay, seeds not procurable here. A copy of the paper in question, and which gives all the information we possess, (now in the press for the Journal) will be sent shortly.

Second.—Applying for information regarding the gigantic fodder grass, *Festuca dives*, referred to in last month's Proceedings—"Enquiries have been made from me for exactly that class of fodder, and I shall be glad to be enabled to give some information on the subject." Application made to Baron F. von Mueller for fuller particulars and for a further supply of seed.

Third.—Submitting detailed reports on trial of *Reana luxurians* at the gardens of Saharunpore, Cawnpore, and Allahabad. (Transferred for publication in Journal.)

Fourth.—Enquiring if any seeds can be supplied of the Cacao plant, and information as to its habit, soil, cultivation, &c. The following memorandum forwarded in reply:—

"*Theobroma Cacao*.—Seeds of the above are not available. A few trees were introduced some thirty years ago into the Agri.-Horticultural Society's old garden, but they all died down in the course of a few years. There are several plants, I am informed, now growing in the Royal Botanic Garden, Calcutta, shaded by a mango tree; they are from five to seven feet high. There was a large tree in existence before the Cyclone of 1864 (which destroyed it.) This tree is said to have seeded.

"The habitat of this tree is tropical America, but is now grown in the West India Islands, Trinidad, Grenada, and St. Lucia. It requires a rich soil for its

proper development. I annex an extract regarding the culture from a paper on the culture and preparation of Cacao which is to be found in the Society's Journal, Vol. IV, old series."

From the Consul General of France, enclosing extract of a letter from the Agricultural Society of French Cochin-China regarding the serious depredations of a caterpillar on their rice fields. Enquiring if it is known in India, and what remedies are employed to modify its ravages. Specimens of the insect applied for.

From Col. J. B. Fisher, in reference to a caterpillar plague at Fort Shabkodar near Peshawur:—

"Thank you for sending the seeds I asked for: I think of sowing the Reana here '[Murree],' writes Col. Fisher, 'our garden in Shabkodur is perfectly overrun and eaten up by caterpillars. We have tried tobacco water with no result, and as for taking them off the plants it would be more than twenty men could do employed all day and every day. I have never seen anything like this caterpillar plague in any part of India. I should be most thankful to any body who could suggest a remedy, as I believe we may expect the same plague more or less every year.'"

From the Superintendent of Forests, Rangoon, applying for fresh tea seed. (To be complied with in proper season.)

From J. E. O'Connor, Esq., applying for some good American varieties of tobacco seed for despatch to the Commissioner of Arracan. (Complied with.)

From the Rev. W. G. Hunt, Hazareebagh, submitting a sample of cotton raised from New Orleans seed, and asks for a report thereon. His cultivation is 4½ acres, and he would wish to extend it considerably, if it would be likely to pay. This cotton is of fair length, strength and color, though not quite equal to original stock.

From Mr. E. W. Presgrave. Remarks on the treatment and propagation of the Amaryllis tribe.

Thursday, the 25th July, 1878.

W. H. COGSWELL, Esq., *V. P.*, in the Chair.

The proceedings of the last meeting were read and confirmed.

Mr. George Takeda was elected^d a Member.

The names of the following gentlemen were submitted as desirous of joining the Society.

Nawab Shamsheer Jung, Hyderabad,—proposed by Mr. J. E. Grimley, seconded by Baboo P. C. Mittra.

C. R. O'Donoghue, Esq., Puttabong Tea Estate, Darjeeling,—proposed by the Secretary, seconded by Dr. Barry.

T. R. Stokoe, Esq., Barrister, Calcutta,—proposed by Mr. J. H. A. Branson, seconded by Mr. Cogswell.

Superintendent of the Nuddea Jail,—proposed by the Secretary, seconded by Mr. Robinson.

Rejoined.—A. C. Pott, Esq., Calcutta, R. D. Stewart, Esq., Julpigoree, and Dr. J. W. Tyler, Agra.

CONTRIBUTIONS.

1. Report on the Wheat cultivation and trade of the N.-W. Provinces. From the Director of Agriculture, N.-W. Provinces.

2. Report of Committee of Bengal Chamber of Commerce, November 1877 to April 1878. From the Chamber.

3. Records of the Geological Survey of India, Vol. XI., Parts 1 and 2.

4. A collection of seeds of Australian trees and shrubs. From Captain C. J. Wilkinson.

5. A plant of *Hippeastrum pardinum*. From Mr. J. Lynam.

Mr. Lynam also sends for inspection a plant of *Oncidium Lanceanum* in flower, which he has found to succeed well here—"It is as hardy as *O. luridum* and requires as much sun; it is not often seen in flower in England. I cannot say whether it has flowered here before or not; it is now a fortnight in bloom and is declining; it was much larger and the color much brighter than it is now when it opened first. It is admirably suited for Calcutta, as it stands both heat and sun. It was sent to England many years ago by Consul Lance from British Guiana."

GARDEN.

The Head Gardener's monthly report was read, of which the following are extracts:—

"The principal works carried on since the 1st instant have been Rose layering, Lichee, 'Gotees,' Lime, &c; 'Gotees' of various shrubs about the garden. The work would have progressed quicker had the early part of the month been more seasonable, but as the weather was rather dry, a considerable amount of the Mallees' time was taken up with watering plants in pots; this also engaged the coolies for supplying water. Now that the weather has settled down to rain, the garden coolies are more fully engaged on their legitimate work of grass-cutting and clearing the garden. Owing to the rapid growth of grass, the garden became very rough-looking, therefore twelve additional coolies (as authorized) have been put on to give the garden a thorough cleaning; they will be retained for a month. The grass is cut by ordinary sickles which serve fairly when the grass is long, but when the next growth attains about six inches it will require cutting again, which would be done more expeditiously and neatly by means of scythes. Several packets of Mahogany seeds which have been receiv-

Proceedings of the Society.

ed from Dr. King have been duly sown and the first lot have germinated; one lot sown 22nd June, has been potted off. Seven different kinds of 'Maize' were sown and are growing nicely after the late showers. Cuttings of various desiderata have been put down in the sand beds. Cuttings of the more valuable plants will be pushed forward as soon as some of the Malles shall have finished layering and inarching, as their hands will then be free; some of the work being a little backward owing to the change of Head Gardeners. Forty kinds of Chrysanthemums (which were bought from Mr. Head) were dead out of 100 kinds, before I took charge, and a few new Crotons have succumbed since, they were in a very weak state. On the 1st July delivery orders came in rapidly, but are each cleared off as soon as possible. A detailed report about the Mahogany seed will be sent in a short time as soon as I see the result of the different methods of sowing which I am trying."

The Garden Committee's report was next read. The Committee suggest the employment of scythemen to cut the grass in place of the present mode of outside cutters, which is by no means satisfactory. The Committee have to report that the mode of conveying water from the entrance tank to the nurseries by means of underground pipes, as suggested in a former report, was completed in April, and has been found to work satisfactorily. (Additional expenditure for engagement of three scythemen was granted.)

MANURE FOR TEA GARDENS.

The Secretary submitted some valuable detailed particulars regarding the application of manures of sorts to tea plants, with which he had been favored by a Mercantile firm largely interested in the Tea industry; whereupon it was *resolved*, that applications be made to some other houses for any information they may be able to afford, and that the same be incorporated in a paper for publication in the Journal.

TOBACCO.

Read a letter from the Deputy Commissioner of Cooch Behar, sending samples of Cooch Behar tobacco cured by Mr. Paterson under the firing process, and asking for an opinion on their quality, and if the tobacco will make cigars, and if it will be fit for the pipe.

Mr. Eisenlohr, a member of the Tobacco Committee, is of opinion that the leaves are well cured, of good colour, and of strong and somewhat astringent flavour.

Messrs. Begg Dunlop and Co. have obligingly furnished reports on this tobacco from their Superintendents at Ghazepore and Poosa. The former writes as follows:—

"The sample of Cooch Behar Tobacco seems to have been fairly well cured, but the colour is not very regular, some of it is altogether too dark: it is how-

ever fairly tough, and has enough life and gum in it. It would, I think, make very passable wrappers for low grade Cavendish, but is, of course, quite unsuitable for cigar making.

"This tobacco has been raised from Rungpore seed, and the texture coarse and the stems large. Had the experiment been tried with American seed it would have been more successful I think."

And the latter observes :—

"I am sorry I cannot say much in its favor. It shows, however, to have been cured in a better climate than either Ghazespore or Poosah. The sample you send is of the Hatican variety, and cured as this is could only be used as fillers for low grade tobaccos, and would have to be mixed with other tobacco to give it flavour. In the English market it would bring about 2d. or 2½d. If cured differently it might make cigars like Burmah Cigars."

APPLICATIONS FOR SEEDS.

Applications were read—

From the Assistant Secretary, Government of Bengal, for a quantity of Virginia tobacco seed for experimental cultivation in the Government Garden at Monghyr. (Complied with)

From the Government of India, Department of Agriculture, for a quantity of New Orleans Cotton Seed for the Government of the N.-W. Provinces for experimental cultivation. (Complied with)

From the Deputy Commissioner of Seonee for seed of *Reana luxurians* for experimental purposes in his district. (Complied with.)

From E. Buck, Esq., for seed of Guinea grass, Reana, flowering shrubs, for the Cawnpore Government Garden. (Complied with.)

COMMUNICATIONS ON VARIOUS SUBJECTS.

Letters were submitted—

From H. E. Abbott, Esq., of Jaintpore Factory, Tirhoot, forwarding sample of cotton raised from the Bamia seed, supplied by the Society, in his late Brother's garden. "There would have been more," writes Mr. Abbott, "but goats were allowed evidently to graze all over the place just after his death, and almost destroyed the plants. I have given a respectable *ryot* all the seed that escaped, and offered him a handsome bonus to bring me the produce, so next year I hope to send you reliable statistics. The sample sent is discolored [it is however of good quality in length and strength] from exposure and carelessness; but its immense superiority over native cotton needs no remark. I would gladly take a large quantity."

From Under-Secretary, Government of India, Department of Agriculture, enclosing copy of a report from the Director of Agriculture, North-Western Provinces, on the experimental cultivation of *Reana luxurians* in those Provinces. (Transferred for Journal.)

From the Director, Department of Agriculture, N.-W. Provinces, forwarding copy of a review by the Government of the Annual Report of the Horticultural Garden at Lucknow for 1877-78.

From the same, forwarding particulars regarding the result of experimental cultivation in the Lucknow Garden of Bamia cotton. (Transferred for Journal.)

From the same, alluding to the expected arrival of a large quantity of American tobacco seed, and enquires if the Society would like to have some of the acclimatized stock in due course. (Offer thankfully accepted.)

From Colonel W. H. Lowther, Benares, alluding in the following extract to the destructive effect on vegetation of the late unusually hot weather:—

“The last fortnight of June is the hottest period I can remember in India. The sun seems to have possessed some *extra* scorching power, as whole gardens of choice ‘Mango’ and ‘Orange’ trees can testify,—dead to the very tap root! I am told at Lucknow and Ghazepore they have suffered equally, and all Gardeners attribute it to the same cause. My garden has suffered in Rose trees and shrubs, and I have lost nearly every novelty raised from seed in pots and boxes, while strange to say *Ipomopsis* in the open borders has withstood; it is now flowering fairly as in the early hot months. It ought to be more generally grown as it is a charming Annual in various colours. Nothing could hurt the ‘Gaillardias’ of all kinds, they have been flowering during the worst time and seemed to thrive in it! Two fine plants of *Romneya Coulteri* in the open border are thriving, while all the promising specimens in pots have perished in the first shower of rain. I find here, as a general rule, that plants do far better in the open ground (well prepared soil of vegetable and animal manures) than in pots. Boxes too are far better than pots as *they do not conduct heat*.”

From W. H. D'Oyly, Esq., applying for certain information regarding flax culture in Bengal and Behar in former years. (Complied with.)

From E. Buck, Esq., enquiring if *Blighia sapida* has been acclimatized in Bengal. “A tree in the Government garden at Cawnpore, imported some years ago by Mr. Halsey, has fruited for two or three years, and I have four young trees of which I shall be glad to send you two if required. It will probably thrive better in Bengal than in this climate. Can you inform me if the fruit is edible, or whether the tree is in any way useful?”

The Secretary placed on the table some fruit of this tree (“Akee”) now ripening in the Society's Garden. It is acclimatized here, but is still a scarce tree, not seeming to be much in request. The fruit is edible, the aril is the edible part, it is said to possess a rather agreeable sub-acid; is sometimes eaten in a cooked state. It is a native of Guinea, but appears to be now common in South America and the West Indies. A small quantity of semi-solid fatty oil is obtainable from the seed by pressure.

Thursday, the 29th August, 1878.

THE HON'BLE L. S. JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last meeting were read and confirmed.

The following gentlemen were elected members :—

Nawab Sumsheer Jung, Messrs. C. R. O'Donoghue, T. R. Stokoe, and Superintendent of the Nuddea Jail.

The names of the following gentlemen were submitted as desirous of joining the Society :—

Rai Jung Bahadoor, Zemindar, Butra, Tirhoot,—proposed by Mr. T. M. Francis, seconded by the Secretary.

A. Forbes, Esq., Calcutta,—proposed by Mr. W. Stalkartt, seconded by Mr. W. H. Cogswell.

Rai Balkrishna, Benares,—proposed by Baboo P. C. Banerjee, seconded by the Secretary.

Herbert Ramsay, Esq., Tea Planter, Kurseong,—proposed by Mr. G. L. Kemp, seconded by Mr. S. H. Robinson.

Secretary, Cantonment Fund Committee, Morar,—proposed by the Secretary, seconded by Mr. Robinson.

Shaikh Sabiuddin, Zemindar, Nowada, Behar,—proposed by Baboo Bimala Churn Bhattacharjee, seconded by the Secretary.

Alfred Anderson, Esq., P. W. D., Dinapore,—proposed by the Secretary, seconded by Mr. E. Broughton.

T. Walton, Esq., N. B. State Railway, Nattore,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Rejoined.—John Martin, Esq., Calcutta ; A. H. James, Esq., District Superintendent of Police, Durbunga, Tirhoot, and J. B. Worgan, Esq., C. S., Chupra.

CONTRIBUTIONS.

1. Report of the Ohio State Board of Agriculture for 1876. From the Board.
2. Proceedings of the Boston Society of Natural History, Vol. XIX., Parts 1 and 2. From the Society.

3. Records of the Geological Survey of India, Vol. XI., Part 3. From Government of Bengal.

4. Transactions of the Asiatic Society of Japan, Vol. VI., Part 1. From the Society.

5. The organic substances of plants and their chemical analysis. Translated by Baron F. von Mueller.

Third supplement to the select plants readily eligible for Victorian Industrial culture, by Baron von Mueller. From the Author.

6. Journal of the Asiatic Society of Bengal, Part 2, No. 2, 1878, and Proceedings for June and July. From the Society.

7. Four pamphlets on Agriculture in India; by Col. A. F. Corbett. From W. Waterfield, Esq.

8. Two nuts of *Lodoicea Seckellarum* in a polished state, and one in the rough state. From General Sir Arthur Phayre, Governor of Mauritius.

Agreed that an application be made to Sir A. Phayre for plants of this rare and interesting palm for introduction into the garden. It is stated that a hundred years elapse before it attains its full growth, and thirty years before it puts forth its flower buds, and ten years are required for the maturation of the fruit.

9. A collection of Palm seeds from the Royal Botanic Garden, Mauritius, From the Director.

10. Seeds of a very large and fine flavored Orange from Syria. From Col. W. M. Lees.

11. A quantity of seed from some very fine Artichokes raised at Deeguh. From John Scott, Esq. Mr. Scott remarks that the seeds are of two sorts, namely, the French and Green Globe, both the produce of very large heads. "To expedite germination I would recommend the steeping of the seeds for eight or ten hours in water. A sowing which I made with seeds thus treated, germinated profusely on the *third* day." (For distribution to Members.)

12. A quantity of strawberry plants raised at Nya Doomka. From W. M. Smith, Esq.. (Arrived in good condition and transferred to Garden.)

The Secretary placed on the table some fine Balsams in flower of the Rose and Camellia varieties raised in his garden from seed gathered last season in the Society's garden.

The Secretary announced the receipt from the press of copies of the Journal of the Society, Part 4 of Vol. V. completing the volume. Part 3 was issued in March last.

GARDEN.

The Gardener's monthly report was submitted, of which the following are extracts:—

"The weather during the past month has been more seasonable, a continuance of such will fill our tanks for the ensuing dry season. The work done has been somewhat a continuation of that recorded last month, and has also included peach and mangoe inarching. A first lot of cuttings of Crotons, Nos. 1-35 have been put down some time back, and more will follow. The 3 scythemen commenced a few days ago, and though awkward in their way of handling a scythe, yet will I hope form the nucleus of a future and permanent band of mowers for the garden. A varied lot of seeds of Australian plants, presented by Capt. C. J. Wilkinson, have been received; also a plant of *Hippeastrum pardianum*, presented by J. Lynam, Esq. A small collection of palm seeds from Royal Botanic Garden, Mauritius, have come to hand, and a nut of 'Coco-de

Mer" *Lodoicea Sechellarum*, presented by Sir A. Phayre, but useless however there being no embryo; from the foramen withinwards it was filled with black powder; the name Double Coconut which is applied to it is not appropriate, as the fan-leaved palm which produces this curious bilobed nut (there are normally three of these nuts in a single fruit) is nearer related to 'Borassus' and 'Latania' than to 'Cocos.' I have not seen any record of its having been used for food. From the Mahogany seeds sown on 5th July we got 280 seedlings, i. e., 25 per cent. germinated; later experiments have been unsuccessful owing to heavy rain. I will sow again when rainfall becomes less. Coolies have all been engaged cleaning garden and grass cutting as before."

A report from the Garden Committee was next read. The Committee offer certain suggestions in respect to the strengthening of the staff of gardeners to make the native establishment more efficient; also to the erection of a Conservatory in which to place specimens of rarer plants and such as are in general demand. The recommendation in respect to the native establishment was confirmed, that regarding the Conservatory to be reconsidered hereafter.

TOBACCO.

In continuation of the reports read at the last Meeting on the specimens of Tobacco from Cooch Behar, the Secretary submitted the following report from Baboo Protapa Chundra Ghosa who had obligingly agreed to have this tobacco manufactured into cigars:—

"The leaves of tobacco you sent me the other day were made into fifteen cigars, twelve of which I send you herewith. The cigars are not yet sufficiently dry, they had better be kept in a closed tin box, a condition so favourable to the slow fermentation of the oily principle contained in the leaves. The leaves are very strong in flavour, and in smoking their wet condition favours the distillation of a good portion of nicotylin which enters the mouth and gives pungency to the taste. The leaves have an aroma of their own which may be likened to that found in the best kind of honeyed Virginian tobacco for chewing; the only difference being an excess of nicotylin, it being present in the proportion of 7 per cent. The ash of a greyish white colour, but I fancy it would improve when a portion of the potassic nitrate with nicotylin has given out ammonium carbonate. A portion of the maleate and citrate salts would be no doubt reduced during fermentation, and the sweet taste which indicates the presence of nearly 2 per cent. of saccharine matter would no doubt be diminished, and the portion of alcohol so generated would again in smoking be converted into saccharine matter and still add to the sweetness of the flavour which every body must have experienced in smoking cigars slightly moistened with toilette vinegar.

"In my opinion the specimen is a fair one, and it might be pronounced as having been well cured. It is best suited for chewing purposes and for covering

cigars. Cigars made entirely with this leaf would, I am afraid, be stronger than Burmah and Coconada. The leaves are finer than those from the above places and are of a lighter colour. It is a pity that the mid rib has not been taken off before curing.

"I shall thank you to send me a couple of the cigars about this time next year."

USEFUL PROPERTY OF THE *PITHECOLOBIUM SAMAN* TREE AS A FODDER
FOR CATTLE.

The Secretary stated that having recently observed in the newspapers an allusion to the above tree he had applied to the Department of Agriculture and Commerce for the papers connected therewith. He had received, in reply, the papers now submitted, consisting of a despatch from the Secretary of State to the Government of India, enclosing a report from the Superintendent of the Castleton Botanical Gardens, Jamaica, and another from Dr. Birdwood. He had also applied for some seed, but all had been previously distributed.

In connection with the above the Secretary called attention to this Society's proceedings for April 1870, in which is recorded the circumstance of some seed of *Inga* (*Pithecolobium*) *Saman* having been presented to the Society by the Hon'ble Major Bourke with the following note:—"I have lately come up from Ceylon, and from a conversation which I had with Mr. Thwaites, Superintendent of the Botanical Gardens, Peradinya, respecting the difficulty that we experience in India in getting fuel for locomotive engines, and in enquiring of him whether he knew of any fast-growing hard-wood tree that was likely to prove useful in this way, he shewed me a tree then growing in the Peradinya gardens and which was planted by him some eighteen years ago, and a huge forest tree it is now.

"He was kind enough also to give me some seeds of the tree, and I take this opportunity of enclosing you a few of them for your use. He told me that in about five or six years it would grow up and be as thick as a man's thigh or cocoanut tree.

"If this is so I think possibly it may deserve a trial, as it is a matter of great consequence to us in India."

The Secretary stated that the seeds received from Major Bourke had been transferred by him to the Royal Botanic Garden, the Society not having then a garden of its own. He now placed on the table a packet of seed, raised from these trees, with which he had been favoured by Mr. Biermann, the Curator of the garden; as also another packet, just received from Dr. Thwaites, Superintendent of the Botanical Gardens, Ceylon, in response to his (the Secretary's) requisition. A portion of this seed had been transferred to the Society's garden, and the remainder is now available to Members and others desirous of introducing this valuable tree.

The following is the report of the Superintendent of the Botanical Garden, Jamaica, on this tree:—

"*Pithecolobium Saman*, or, as it is popularly known in Jamaica, *Guango* is, as an æsthetic feature, one of the most magnificent subjects in the existing Jamaica Flora. Originally brought over from the American mainland as seed, by Spanish cattle, it has become most thoroughly naturalized in all the dry regions, especially in the Salt Ponds districts, a low-lying part of St. Catherine Parish towards the sea, where it was first established.

"It is a lofty tree, with patent tortuous limbs, in general habit and custom much resembling the English Oak. The trunk is three to six feet in diameter, generally short, and branched a few feet from the ground. The primary branch divisions are often tree-like in size, measuring nine to twelve feet in circumference at the base. The lower branches spread horizontally, and the upper are erect spreading, giving the tree a flattish dome-shaped appearance. The span of the wide reaching boughs is usually in good specimens over a third greater than the height of the tree. Trees are not infrequent, seventy feet high, the diameter of whose branch expansion horizontally is over one hundred and thirty feet.

"The shade which this tree affords is of a light lifesome character with gleams of sunlight stealing through and flitting about as the branches move with the breeze. This characteristic with the fact—which is of equal importance to healthy vegetation—that the leaves and leaflets rigidly close together at night, thus admitting the free descent of dew to the ground together with its squat-like brooding habit, form its first great value as a pasture tree. It is, without doubt, the finest pasture shade tree on the island. Grass grows as freely within the overshadowing of its ample arms as without close up to the trunk. In this circumstance alone it should be planted sufficiently in pastures wherever it will thrive as a grateful shade for cattle. Beyond this is the important consideration of its being a fodder-yielding plant itself, and this hardly in a secondary sense either for the quantity or quality of the yield.

"The fruit is a bright dark coloured pod when ripe, six to ten inches long, hardly one inch by a quarter of an inch thick, in substance consisting of a sugary amber coloured pulp. These pods are borne in great profusion, and hang prior to their maturity, dangling in clusters from every branchlet. As they ripen, they drop to the ground, and are picked up and eaten with much relish by all stock, even sheep and goats. Cattle may be seen lingering about the trees waiting for the passing breeze to shake the fruit down. Its excellent quality as a fodder is evident by its fattening effect. Stock having access to it, improve markedly during the time it is in season.

"From the sugary nature of the substance of the fruit, it will keep a good while packed after maturity. It is, therefore, often gathered on the pens, packed in barrels and kept for use till the dry early spring season has parched up grass and made herbage scarce.

"There is no doubt, I think, that it would make as good a preserved cattle-food mixed with other ingredients as the 'Carob' (*Ceratonia Siliqua*), which

is largely imported into England from the shores of the Mediterranean for this purpose. *Pithecolobium Saman* thrives best in dry hot plains, having a small or moderate annual rainfall. It is true very large trees are occasionally found in wet districts, but they lack the conspicuously healthful and luxuriant branch development of trees on the plains. They are also very much less fruitful, and the fruit is less plump and mucilaginous in substance. Hot plains having an annual rainfall of from thirty to sixty inches, appear best adapted for its successful growth, either spontaneously or by cultivation. Like many other plants too, there is no doubt that a maritime influence is particularly favourable to its development.

"The utility of this plant as a shade and ornamental tree for open places of resort and wayside has not been mentioned. Its ample spreading habit, the clear refreshing green of the light foliage, the bright cheerful bloom, the quick growth and not least light shade, recommend it as one of the few first-class trees for park and avenue planting. It is unnecessary to point out to residents in tropical countries the value of shade trees along suburban and country roads. In many instances, nature has done a great deal to protect tropical roads. The cases are much rarer where man has done anything systematically to supplement her efforts. There are many subjects in the Jamaica Flora well adapted for use in park and avenue planting, but none having a combination of so many valuable qualities as *Pithecolobium Saman*.

"Though of a quick growth, the wood is hard and very ornamental in grain.

"In concluding this notice, I may mention that the circumstance which has brought the tree into prominence now, of a fine spray-like rain being distilled from the young foliage during the day, sufficient to moisten the ground, has not been observed in Jamaica; but though it cannot be proved to be more than locally at most a 'rain tree,' the many and universally permanent good qualities which it possesses, some of which I have mentioned, justify amply its cultivation wherever it will thrive."

CULTIVATION OF THE BANANA IN AUSTRALIA.

The subject which next came under consideration had reference to a valuable paper by the late Mr. Kurz which is published in a recent number of the Journal entitled "The Banana: a pomological contribution." This paper had attracted the attention of Mr. L. A. Bernays, Vice-President of the Acclimatisation Society of Queensland, and the following is extract of a letter dated 18th June from that gentleman:—

"I enclose for your information copy of report of the last meeting of the Council of this Society, and beg to draw attention to that portion of it which refers to the statement made in the pages of your valuable Journal that the Banana is not cultivated in Australia. I am sure that the writer of the article and the Members of your Society will be glad to be corrected upon a point

in which they were so wide of the actual facts. The contradiction is made, and I hope will be accepted by Mr. Kurz, in the best spirit; but it came upon us as a surprise to find that it was not known in scientific circles in India that Queensland is a large and very successful producer of many kinds of the best Bananas. The production is confined to the warm coast lands of the Colony, but occupies many hundreds of acres of the best lands. Some years ago serious alarm was created by the appearance of a disease which destroyed thousand of plants, and great apprehensions were felt at the impending ruin of a large number of farmers who depended for their livelihood entirely upon the Banana. Fortunately, however, this disease proved to take its origin like many others, in purely atmospheric causes, and while remedies were being discussed, it gradually disappeared.

"I believe myself that the figures which I quoted at our meeting might be doubled, and still be within the truth, as I have since found that the returns given me by the Customs referred to the Port of Brisbane only."

Extract from the Proceedings of a Meeting of the Council referred to in the above letter. "He (the Vice-President) was informed by the Customs Authorities that the total value of green fruit exported in 1877 was £4,992. Crediting bananas with £2,500 of this would be under the mark, if any thing; and adding, as a moderate estimate five times the amount as the home consumption, will give £12,500 as the value of this product for 1877, for Queensland alone. But the banana is largely cultivated on the northern coast of New South Wales also; and £20,000 a year would probably not be an exaggerated estimate as the value of the Australian product of this useful fruit, which enters so largely into the food of the people. He had no doubt that the writer in question would be glad to be corrected; but he instanced the matter rather to show how much still remains to be done before the outside world knows what are our resources. He quite hoped that the International Exhibition, to be held in Brisbane in 1880, would open the eyes of at least our fellow subjects in other parts of the British possessions."

COMMUNICATIONS ON VARIOUS SUBJECTS.

From the Director of Agriculture and Commerce, N. W. P., forwarding a report on poisonous properties of Jowar. (Transferred for publication in Journal.)

From the Inspector General of Forests, copy of a memorandum by Mr. Gamble, Assistant Conservator of Forests, on the different species of American *Prosopis*. (Transferred for Journal.)

From the Under-Secretary Government of India, Department of Agriculture, conveying the thanks of the Japanese Government, for assistance rendered last year by the Society to three officials in their investigations connected with the Tea industry of India.

From the Assistant Director Royal Gardens, Kew, applying for duplicates of missing numbers of the Proceedings of the Society and for two copies of each future number. (To be complied with.)

From the Acting Superintendent Government Farms, Madras, applying for an exchange of publications. (To be met.)

The letter last submitted was from the Secretary India General Steam Navigation Company. The Secretary stated that in consequence of several Members of the Society, Managers of Tea Gardens in Assam and Cachar, being deterred from availing of their privileges of indenting on the garden for plants in consequence of the cost of freight on boxes, he had, with the concurrence of the Council, applied to the I. G. S. N. Co. for a reduction of freight in consideration of the large quantity of tea annually brought down by the Company.

From the reply now read it would be seen that the Directors "had given the subject due consideration, but could not see their way to make the reduction asked for."

Thursday, the 19th September, 1878.

W. H. COGSWELL, ESQ., *V. P.*, in the Chair.

The proceedings of the last meeting were confirmed.

The following gentlemen were elected members:—

Rai Jung Bahadur, Rai Balkrishna, Messrs. Herbert Ramsay, Alfred Anderson, T. Walton, A. Forbes, Secretary Cantonment Fund Committee, Morar, and Shaik Sabiuddin.

The names of the following gentlemen were submitted as desirous of joining the Society:—

James Caldwell, Esq., Emigration Agent for Natal,—proposed by Mr. H. A. Firth, seconded by Captain C. J. Wilkinson.

Shaikh Ahmed Ali of Bihar,—proposed by Baboo Bimalachunder Bhutta-charjee, seconded by the Secretary.

Alfred W. Neville Wyatt, Esq., Bhukeyan Indigo Factory, Tirhoot,—proposed by Mr. W. H. Cogswell, seconded by Mr. John Thomas.

Robins Cooke, Esq., of Doolubcherra, Cachar,—proposed by Mr. Joseph Binning, seconded by the Secretary.

GARDEN.

The Gardener's monthly report was submitted, of which the following are extracts:—

"The chief work during the past month has been potting off goties and cuttings and miscellaneous propagation, with the object of getting as large a stock as possible before issuing the same. Orders have come in briskly, and have been executed as per demand, as far as the stock in hand permitted. Members, especially those at a distance, would greatly oblige if they were to add a secondary list to their indents for plants, to prevent disappointment and delay in making up orders. We have a fine stock of large sized Crotons suitable for hall, staircase or verandah decoration: *Coffea Arabica* we have over 2,000 plants three feet high and upwards: a small batch of *Avocada Pear* (*Persea*

Proceedings of the Society.

gratissima) are available. Cuttings of Liberian coffee have been put down; they are all healthy, but only form a 'callus' after 1½ or 2 months; would perhaps get on better with bottom heat. Two of the large plants out in the garden have a quantity of berries (30-40) on them, but they are very slow at ripening or even colouring; after increasing to their full size in a green state, the outer skin turns black and shrivels up in a few days and the berry falls down. The seeds from these berries on examination are apparently fully developed, but have hitherto failed to germinate."

Letters were read—

From the Secretary Tukvar Tea Company, forwarding specimens, in various stages, of red-spider.

From E. L. Edgar, Esq., of Cossipore Garden, Cachar, submitting specimen of an insect which he has not observed before, found on a partially eaten tea-leaf.

From F. Moore, Esq., of the India Museum, London, expressing a wish for specimens of red-spider and other noxious insects for examination.

The Secretary mentioned he had sent the above specimens to Mr. Moore.

From the Assistant Secretary, Department of Agriculture and Commerce, requesting the aid of the Society towards obtaining hybrid tea seed for trial in the Arakan Hills. (To be complied with.)

From the Director Agriculture and Commerce, N. W. Provinces, applying for a large quantity of Guinea grass seed for next year's sowings. The Secretary stated he was endeavouring to meet this application.

From a Correspondent in London on the subject of the fruit of the Bengal Date, and whether it could be profitably exported; and he adds, "I am at a loss to know why the superior *Phoenix dactylifera* is not cultivated in Bengal in lieu of *P. sylvestris*. I have had both kinds in my garden (in Calcutta) and found the former to grow at least as well as the native description. The consumption of Persian Gulf dates in this country is now enormous, and, notwithstanding their very low prices, say £ 6 a ton, they are still apparently a paying crop."

The Secretary remarked that the question of the introduction of the Arabian Date into Bengal had been discussed several times by the Society in past years, but he was not aware if it had been carried out to any extent. A former Commissioner of Patna, Mr. Ravenshaw, had tried it but found the tree very slow of growth as compared with the Indian Date. Large quantities of the Persian Date were allowed to rot on the ground, according to the *Times* Correspondent, for want of carriage to the sea board.

Proceedings of the Society.

Thursday, the 24th October, 1878.

S. H. ROBINSON, Esq., *Vice-President, in the Chair.*

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. James Caldwell, A. W. N. Wyatt, Robins Cooke, and Shaikh Ahmed Ali.

The names of the following gentlemen were submitted as desirous of joining the Society :—

The Superintendent of the Botanical Gardens, Saharanpore,—proposed by Mr. E. Buck, seconded by the Secretary.

Charles Roberts, Esq., Kursiong, Darjeeling,—proposed by Mr. G. L. Kemp, seconded by Mr. S. H. Robinson.

Manager Noohabaree Tea Estate, Assam,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Manager of the Punkabarree Tea Co., Punkabarree,—proposed by Mr. Kemp, seconded by Mr. J. E. MacLachlan.

CONTRIBUTIONS.

1. The "Indian Forester," July 1878. From the Editor.
2. Annual Report of the Supt. of Govt. Farms, Madras Presidency, for year ending March 1877. From the Superintendent.
3. Memoirs of the Geological Survey of India, Vol. XV., Part I. From the Director.
4. Report on the Royal Botanic Gardens, Kew, 1877. From the Director.
5. A further supply of Reana seed and some Maize seed raised from American stock. From Dr. Lynch.
These cobs of maize are nearly equal in size to the original stock.
6. Seeds of *Kentia Wendlandtiana* and *Eucalyptus Baileyi*. From L. A. Bernays, Esq., V. P., Queensland Acclimatisation Society. Mr. Bernays states that this is a new *Eucalyptus*, lately found in the Brisbane district in hot dry situations, and in recognition of its discoverer it has been called *E. Baileyi*.
7. Seed of the Falkland Island Tussack Grass (*Dactylis cespitosa*). From Baron Ferd. von Mueller.
"I got the seeds," observes the Baron, "from Sir Joseph Hooker, who procured it from the Shetland Islands. Of course it would only be adapted for the Alpine country of India."

8. A few seeds of the "Akee" (*Blighia sapida*) raised in the Cawnpore Government Farm. From the Director Agriculture, &c., N.-W. P.

HORTICULTURAL EXHIBITION.

A recommendation was submitted from the Council that the next show of vegetables, fruits and flowers be held the last week of January 1878, due notice of details being given in the early part of that month. Agreed to.

GARDEN.

The following report from the Head Gardener was read:—

"The work during the past month has been chiefly potting off the young stock. Coolies were quite as active as last month cutting grass and cleaning up the garden, as the late close and showery weather has been highly conducive to the growth of weeds. An extension of the old plant sheds has been made ~~so~~ as to embrace the propagating beds under partial shade and thereby give facilities for increasing stock. Many pans of various Palm seedlings, which had been lying by, were potted off early in the month. The collection of Australian seeds sown on 28th August have, up to the present, shown little signs of germination, I am afraid the seed must have been old. The Palm seeds from Mauritius, sown same date, have partly shown themselves. The seeds of *Pithecolobium saman* from Royal Botanic Gardens at Havrah, sown on 13th September, germinated, and have been potted off. Of Liberian Coffee seeds, three batches have been sown. The first lot were sown on 28th August and germinated, on 27th September, but the cotyledons of several have not yet freed themselves from the integuments of the seeds; some cuttings of the same which I put down about three months ago, are still alive and green and slightly growing, but have simply formed a large white 'callus' at base, without the trace of a root as yet. The trial sowings of imported seeds were commenced a few days ago, the percentage of germination will be given early. I herewith forward two flowers of *Hibiscus rosa sinensis miniatus semi-plenus*; the semi-double appearance is produced by a petaloid condition of the staminal filaments, which are broken up into several parcels instead of being monadelphous. These flowers are difficult to secure in a perfect state, for as soon as they open an orange and black barred beetle '*Mylabris Cichorii*' attacks them. It seems to be particularly fond of this semi-double Hibiscus, as the large single flowers of the other '*Hibisci*' near at hand are untouched by them."

HORTICULTURAL NOTES.

Read the following extracts of letters from Col. W. H. Lowther, Benares:—

September 23rd.—"The damp is excessive, and I have lost nearly all my early sowings of Cauliflower and the Cabbage tribes, but Endive and Celery are fine beyond all expectation. Most rainy season flowers *poor*, especially Amaranthus and Balsam, excessive rain has damaged their growth: such rains have not visited Benares for ten years. Every promise of a good harvest, from hence to Bombay I hear the same account. Just the year for '*Lucerne* and *Reana luxurians*' where previous irrigation was available. I lost my field of '*Lucerne*' in those torrid months of June and July, my well having run dry, but some plots near water supply have been so prolific, since the rainfall, that they gave perpetual cutting, and I find them ample for three horses up to date."

October 12th.—"I hoped to have sent some novelties, most of which have been destroyed by the late hot months, though the nights have commenced to be cool,

yet the temperature by day is far above that of October last year by many degrees, yet snow was seen on the Hindu Kosh in *August*, the earliest within the memory of any European in India, and we may have a long and severe winter in the North-West, producing a good cold season here in the Lower Provinces. Benares was never so healthy to Europeans as in 1878, only one death by cholera and two casualties by fever among British troops. I think the amount of wind, (almost daily breezes in the whole twelve months) is the source of our sanitary condition. Can you spare me a pinch of *Reana luxurians* seed, my few plants are too young to bear any in this year, they were given to me rather too late in the rains for quick growth.

"The crops are wonderful here. I never saw such tall *bajerow* before: September's daily showers and sunshine did the work; it was the finest month in our year for agriculturists and gardeners, and tolerably cool.

"I gave half my *Reana luxurians* to the Rajah of Benares, with a strong recommendation to cover his lands with this crop, and of the remainder I gave part to a gentleman who is greatly interested in fodder plants.

"My Guinea grass I have dug out and burnt, for I nearly lost a fine bullock to which an over quantity was given, and many years ago I had a large spotted deer killed by getting at a field of this grass during the night; and now being afraid of its effects on valuable horses, I have thought it prudent to get rid of this boasted forage."

Letters were read—

From the Department of Agriculture and Commerce, Govt. of India, forwarding certain papers connected with the introduction of the Arabian Date Palm into Oude. (Transferred for Journal.)

From the same, requiring a quantity of hybrid Tea seed from Assam, for cultivation in the Arracan Hill tracts. (To be complied with.)

From the Director of Agriculture, N.-W. P., requesting that a quantity of Alpine Oats be imported for Government. (To be attended to.)

From Messrs. Ede and Hobson, Agents for Messrs. Ohlendorff & Co., submitting a copy of Messrs. Ohlendorff's pamphlet on Guano, and offering a certain quantity for trial and report. Accepted.

From Major. Protheroe, Port Blair, Andamans, applying for a quantity of native vegetable seeds for the island. [Complied with partially through the kind assistance of Dr. Lynch]. Major Protheroe adds, "you will be glad to hear that the tea plantation is thriving. We have about fifteen beegahs under tea quite enough to determine whether the experiment will succeed. The plants which were put out in March are growing vigorously, and I have great hopes of our ultimate success."

Thursday, the 28th November, 1878.

THE HON'BLE L. S. JACKSON, C. I. E., President, in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected members :—

The Superintendent, Botanical Gardens, Saharunpore ; Mr. Charles Roberts ; Manager of the Nohabarree Tea Estate, Assam, and Manager of the Punkabarree Tea Company, Punkabarree.

The names of the following gentlemen were submitted as desirous of joining the Society :—

Walter Knaggs, Esq., Trafalgar Estate, Singapore,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Edward Scarth, Esq., Ningri Ting Tea Factory, Assam,—proposed by Captain W. J. Williamson, seconded by Dr. E. Gray.

Baboo Grija Prosunno Mookerjee, zemindar, Goberdanga,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

The Hon'ble Justice Wilson,—proposed by the President, seconded by Mr. W. S. Creswell.

CONTRIBUTIONS.

1. Transactions of the Asiatic Society of Japan, Vol. VI., Part 2. From the Society.

2. Journal of the Asiatic Society of Bengal, Part 1, No. 2, and Part 2, Nos 2 and 3, 1878. From the Society.

3. A number (88) of rare Mango grafts and 12 Lychee grafts, prepared in his garden at Utterparah.

Presented by Baboo Rajkissen Mookerjee. A special vote of thanks was accorded to the Baboo for this acceptable donation.

4. A case of plants from the Botanic Garden at Singapore. Presented by the Superintendent.

5. A small quantity of seeds of tuberous Begonias and of *Momordica sanguinea*. From Samuel Jennings, Esq. (Transferred for sowing in the Garden.)

6. A packet of Geranium seed from Naini Tal plants. From T. M. Francis, Esq. (Transferred to Garden.)

7. Four varieties of Patna Millets. From John Scott, Esq.

8. Seed of the "Forbidden fruit" (*Citrus*—?) from the West Indies. From Col. W. M. Lees.

9. A few more seeds of the "Aki," (*Blighia sapida*) and of Ladak tobacco. From the Department of Agriculture, N.-W. P.

10. Four healthy seedlings of the tea plant from Assam. Presented by W. E. Smith Esq.

GARDEN.

The Gardener's monthly Report was read as follows :—

"The weather having become more open during the month, the grass-cutting work of the coolies was somewhat lighter, which gave an opportunity for utilizing their services in a more general way, making new roads, repairing existing ones, and tidying up for the cold season. As authorized, twelve extra hands have

been secured for a time, to prepare flower beds, repair roads, &c., as the original staff are all engaged in the afternoon watering which, as our water supply stands at present, will always prove an heavy item nine months out of the twelve. Potting off young stock, fruit grafts, &c., taking off rose layers, sowing seeds, and watering have occupied the mallees' attention, to say nothing of the D. O's, which are as brisk as ever. The Liberian Coffee seedlings are I find of extremely slow growth; a couple of seeds of the second sowing (sown 1st October 1878) have germinated. In this same pan I tried a few green berries, but otherwise firm and full sized, and apparently only requiring a few days more to colour, but they failed to germinate. This would seem to indicate that the berries must be left on the plants till they are coloured more or less. I have hopes that I shall be able to succeed better with the cuttings as soon as I get some bottom-heat in the propagating house. A case of plants has been received from the Singapore Botanic Garden, the plants being in fair condition. Consignments of various other seeds have been received and duly sown. A paper, shewing the percentage of germination of vegetable seeds in the trial sowings of 1878, is herewith enclosed; they were all sown under exactly the same conditions. The seeds from Messrs. Sutton and Sons of Reading have certainly taken the lead in both germinating powers and robustness of the seedlings. A report of the germination of the imported flower seeds will be sent in next month."

The tubular statement of trial sowings shews that the English seeds have germinated best, and the American second, whilst the French and German have germinated but indifferently. It was agreed to reconsider this at the next monthly meeting when the trial sowings of flower seeds will be submitted.

REPORT ON THE COMPARATIVE WORKING OF CERTAIN PLOUGHS.

A report from Dr. S. Lynch on the above subject was submitted.

RESULT OF SOWINGS OF REANA LUXURIANS AND LUCERNE IN THE AGRA DISTRICT.

The subject next introduced was a communication from the Manager of the Agra Ice Company regarding the cultivation of Lucerne Grass and Reana luxuriants:—

"Some of the seeds of Reana luxuriants with which you kindly furnished us, sown in April last, 6 feet apart, produced 30 to 40 seers weight of fodder at first cutting in September. Seeds sown in October of last year, surviving the winter, and one sharp white frost on 6th January, this year, yielded a first cutting in April, and a second in October; but on the whole we think the soil more profitably employed with Lucerne which, *except in the rains*, when indigenous weeds and excess of moisture seem to choke it between them, yields a fair cut even on our poor soil monthly, and doubtless with manuring (which we purpose) the plants, which are now springing into a vigorous resuscitation quite refreshing to the eye in this dull brown barren looking locality, will exceed their former out-turn. A plot sown in September 1878, nearly killed by the long

drought of 1877, yielded early in this year repeated cuttings, of 25 to 30 inches in length, and good substantial thickness of stalk in 25 to 30 days; in one case we noted 30 inches in 21 days. We have abundance of water and irrigate as to keep the surface from absolute dryness; *beyond this*, this plot had no manure, until later on. The soil is a mixture of sand, yellow loam, and small debris of building—poorest stuff.

“We note these facts as they may interest you or serve to inform some one who wants to know about Lucerne which strangely enough seems little known in this district.”

PROGRESS OF COFFEE AND TEA CULTIVATION IN THE ANDAMANS.

Read the following extract of a letter, dated 10th November, from Mr. O. H. Brookes on the above subject:—

“I went to inspect the Tea Plantation at the New Clearing on Saturday last. The plantation is situated on rising ground about 150 feet above the level of the sea, there are about four acres of land under Tea cultivation, and there are approximately about 10,000 plants. The first beds planted look remarkably healthy, they were planted out about March and are now on an average about 18 inches high, and have thrown out four and five stems each: these plants were raised from China seed. There are also Assam plants of more recent planting and consequently lesser growth, but these too are looking strong and healthy; the plants are planted about five feet apart, field rats are destructive to the small plants, but the introduction of cats will prevent this to a great extent. The Coffee plantation at Mount Harriet is in a flourishing condition. I have seen some of the plants almost breaking with the weight of the berries, there are about 1,20,000 plants, and of these there are about 30,000 now in bearing, and we anticipate a crop of from 8,000 to 10,000 lbs. of coffee this season, so we shall hereafter be well off in coffee and tea. Sugar could be manufactured in large quantities, as the cane grown here is excellent. In 1881, when all the coffee plants will be in bearing, we ought to get a crop of 50,000 lbs. of coffee.”

REMARKS ON THE PAST SEASON IN THE BENARES DISTRICT.

The following communication from Mr. C. Nickells of Pussena Factory, Jaunpore, was next submitted:—

“At the monthly general meeting of the Society held on the 24th October, under the head Horticultural Notes, a letter was read from your Benares correspondent. He says ‘the damp is excessive,’ and again ‘such rains have not visited Benares for ten years.’ I am an Indigo Planter and my experience tells me, and I am sure all planters will agree with me that the past rainy season has been an *excessively light one* with two exceptions, *viz.*, 1873 and 1877. The showers were few and far between, and the heaviest fall did not exceed 2½ inches; the damp was certainly not excessive, and the little rain that did fall came at the right moment, which was the principal cause why the *khareef* crop was so fine.

Proceedings of the Society

"I cannot agree with your correspondent about the past being the heaviest rainy season within the last ten years. The years 1874 and 1875 were indeed heavy rainy seasons; in those years the rains began early and left off late. It rained sometimes for a fortnight at a time and five to ten inch showers were of common occurrence. In the flat lands water flowed out of the wells, and of course the *khareef* crops were an entire failure: even the succeeding *rubbee* did not do well owing to the lands not being ploughed sufficiently.

"I don't think the crops (*rubbee*) will be fine this year unless rain falls soon. There is hardly any moisture in the ground at least not sufficient to mature the crops."

Letters were read—

From Col. W. H. Lowther: a few hints in connection with a Gardener's Note Book. (Transferred for Journal.)

From T. M. Francis, Esq.: the substance of a paper in the *American Agriculturist*, regarding a novel mode of putting down cuttings of hard-wooded plants. (Transferred for Journal.)

From Samuel Jennings, Esq., a few notes on tuberous *Begonias*. (Transferred for Journal.)

From the Deputy Conservator of Forests, Tounghoo Division, applying for a quantity of tea seed for the Thandoungyer plantation. (To be complied with.)

From the Secretary, Royal Horticultural Society, London, returning thanks for certain seeds.

Before the meeting separated Mr. James Caldwell drew the attention of members to a collection of forty-four water color paintings, full size, of as many varieties of sugar-cane, collected by him in New Caledonia in 1869 and 1870, for the Colony of Mauritius. The whole of these, with many other kinds from other localities, were introduced in Wardian cases, to renew the original cane plants previously cultivated, which had so deteriorated from long and exhaustive cultivation as to bring the sugar industry and the Colony, to the verge of ruin. The result was completely successful, and the original outlay advanced, Government was not only fully repaid but left a considerable surplus. The paintings now exhibited were made in New Caledonia from the plants, as actually collected, by Madame de C. Moon, a distinguished amateur flower painter, (who has largely illustrated the botany of Mauritius) and, from their truthfulness and finished execution, they form a singularly interesting collection, as remarkable for their unexpected varieties of colouring and form, as for their novelty.

The best thanks of the Meeting were accorded to Mr. Caldwell for the exhibition of these drawings, which were much admired, and for his remarks thereon.

Mr. Caldwell kindly consented to allow the portfolio to remain for some weeks in the Society's rooms, for the inspection of those who take an interest in sugar-cane cultivation.

Proceedings of the Society.

xlvii

Thursday, the 19th December, 1878.

THE HON'BLE L. S. JACKSON, C.I.E., *President, in the Chair.*

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. Walter Knaggs, Edward Scarth, Baboo Grija Prosunno Mookerjee, and the Hon'ble Mr. Justice Wilson.

The names of the following gentlemen were submitted as desirous of joining the Society :—

T. T. Leonard, Esq., Bangalore,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

The Manager Lallachorra Garden, Cachar,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

W. St. Clair Grant, Esq., Latipore Concern, Bhaugulpore,—proposed by Mr. G. H. Grant, seconded by the Secretary.

Manager Paikpara Estates,—proposed by the Secretary, seconded by Mr. Cogswell.

Rejoined.—Major W. Franklin, 2/14th Regiment, Lucknow.

CONTRIBUTIONS.

1. The *Indian Forester*, No. 2 of Vol. IV. From the Editor.
2. Proceedings of the Agricultural and Horticultural Society of Madras for past three years. From the Society.
3. Report on the Internal Trade of Bengal for 1877-78. From Government of Bengal.
4. A Wardian case of plants. From the Acclimatisation Society of Queensland.

GARDEN.

The Gardener's monthly Report was read, of which the following are extracts :—

"The work done has been somewhat similar to last month. Road-making and repairing, tidying up flower garden, &c. The only two remaining malees we have been engaged amongst the roses, propagating house, and potting."

Resolved, that renewed efforts be made to secure the services of at least 6 good malees, though it may be difficult to do so as the demand for this class appears to exceed the supply.

Mr. Gleeson submits reports on the condition of two Wardian cases of plants received from the Botanic Garden, Singapore, and from the Queensland Acclimatisation Society. Of the former (46) 9 have died: of the latter (59) 17 have died.

It was resolved that the Annual Exhibition of flowers and vegetables be held on Tuesday the 28th January, and the details submitted by the Council were agreed to. Due notice to be given by advertisement early next month.

Proceedings of the Society.

In respect to the provision of vegetable and flower seeds for next year it was resolved that the orders be confined to England and America, as those imported this year from France and Germany have not been generally well reported on.

It was further agreed that a collection of bulbs and tubers be imported in due season from England, to be disposed of to Members at cost price; also ornamental plants and fruit grafts, on due security being given by applicants, as to the amount cost of the same.

The Council submitted the result of their endeavours in the past two years towards the engagement of a practical Entomologist in connection with blight of various kinds affecting tea plants. Several references both by circular and personal application had been made to various Agents connected with the tea industry. Some had readily promised to support the scheme, provided others would agree to do so. As however, many, though apparently well inclined, would not come to any definite understanding, the Council now suggested with regret that the project be abandoned. *Resolved*, that the recommendation of the Council be adopted.

FIBRE OF *MALACHRA CAPITATA*.

Read a letter from Mr. J. E. O'Connor of the Department of Revenue, Agriculture and Commerce, forwarding a sample of the fibre of *Malachra capitata* prepared at Bombay and sent to him by Dr. Gray. (Mr. O'Connor's notes on this fibre are inserted in the last published number of the Journal, Vol V., Part 4.)

The Secretary intimated that the Members of the Fibre Committee had examined the above sample and submitted the following remarks thereon:—

Minute by Mr. S. H. Robinson.—"I have no doubt this fibre would prove a good substitute for jute for most purposes to which jute is applied; but it seems rather more harsh, and its spinning qualities should be tested in one or two Jute Mills before giving a very decisive opinion. To ascertain whether it would prove economically a substitute for jute, we should require to know the yield of fibre per beegah or acre, and the cost of cultivation and manufacture."

Minute by Mr. W. H. Cogswell.—"This sample is beautifully bright and clean, fair length and good strength of staple, but somewhat harsh. I doubt if it would make a good warp yarn in itself, but mixed with good jute it would do so. The fibre for spinning is not so valuable as jute, it lacks the forked ends, when broken, such as the latter possesses, and partakes of the character of the fibre known as 'Meshta,' which, when broken, looks as though it had been cut and left with square ends."

"Before its value as a spinning fibre could be fairly assessed in competition with jute, it would be needful to show cost of production, out-turn per beegah, &c.

Letters were read—

From Director Department of Agriculture and Commerce, N.-W. P., submitting for an opinion a small specimen of colored seeded cotton raised in the Etawah district from seed brought from Mecca. This specimen being too small for satisfactory examination, a further and larger quantity has been applied for. The seed has been sown in the Society's Garden.

From J. F. Duthie, Esq., Superintendent of Botanic Garden, Saharunpore, forwarding seven different specimens of cotton raised in the garden. Referred to Cotton Committee.

From H. L. LeMesurier, Esq., Minister of Public Works in Egypt, applying for seeds of Jute, and notes on cultivation thereof. Complied with. Mr. LeMesurier applies for seeds of various other useful plants which he wishes to introduce into Cairo. This request is receiving attention.

From the Assistant Director Royal Gardens, Kew, returning thanks for back numbers of the Society's proceedings.

From the Secretary Agricultural and Horticultural Society, Madras. Returning their thanks for Journal, Vol. V., Part 4.

For the above communications and presentations the best thanks of the Society were accorded.

A. H. BLECHYNDEN,

REPORT
OF THE
Agricultural and Horticultural Society
OF
INDIA
FOR 1878.

*Report from the Council at the Annual General Meeting, held on
the 27th February, 1879.*

THE Council have to submit their Annual Report on the operations and the present position of the Society.

The number of new Members elected (65) is less than in 1877: the resignations (53) are much the same. The number removed for non-payment of subscriptions is 53; for deaths* 10, and 14 for long absence from the country. These reduce the number to 690 classified as follows: viz., 31 Life Members; Honorary, Associate and Corresponding 18, and nominal-paying Members 641. Of this number 53 are absent from India, and 73 have failed to contribute to the funds of the Society in 1878; thus making the actual effective numbers of paying Members 515.

The distribution of Members, as they now stand, is shewn by

* W. O. Beckett, P. T. Carnegie, F. Halsey, W. Harlow, H. B. Lawford
G. B. Macouochie H. Raban, J. Sutcliffe, V. T. Taylor, and Sir J. Wemyss.

the following list. Of the whole, 136 are resident in Calcutta, 478 in other parts of the country, and 76 in Europe :—

CLASSIFICATION.	In 50 previous years.	In 1871.	In 1872.	In 1873.	In 1874.	In 1875.	In 1876.	In 1877.	In 1878.	Gross Total.	Total real number at the close of 1878 after deducting lapses.
Honorary Members ...	20	2	0	0	0	1	1	0	0	24	9
Associate „ ...	6	0	0	0	0	0	0	0	0	6	2
Corresponding „ ...	14	0	0	0	1	0	0	0	0	15	7
Civilians, Covenanted & Uncovenanted ...	693	24	14	10	14	16	14	5	6	796	73
Merchants and Traders...	606	14	10	10	18	15	9	2	4	688	87
Agriculturists ...	596	22	27	19	41	90	30	31	17	873	244
Military Officers ...	639	34	12	15	4	4	6	4	4	722	68
Medical „ ...	229	8	8	7	6	7	5	2	4	276	36
Asiatics ...	267	16	8	8	25	10	15	19	8	376	96
Clergy ...	39	0	1	1	0	0	0	0	0	41	3
Law Officers ...	121	4	4	2	6	6	1	0	4	148	21
Miscellaneous, Police, Civil Engineers, &c. ...	137	9	3	17	8	12	10	17	18	231	44
Total ...	3,367	133	87	89	123	161	91	80	65	4,196	690

The financial position has next to be noticed. It is much the same as last year. The best acknowledgments of the Society are due to His Honor the Lieutenant-Governor for the continuance of the monthly grant of Rs. 200 for another three years. Though there has been a decrease of expenditure on some heads, there has been an increase for the Garden and Journal departments, which nearly equalizes the account. Deducting the liabilities (Rs. 2,123) from the cash balance in the Bank of Bengal (4,818) and arrears of subscription, &c., (2,096) (of

which, however, the complete realization cannot be relied on) there would be a balance in favor of the Society of nearly Rs. 5,000.

Of the amount of arrears (Rs. 2,001) of the past 3 years, 1875-77, the sum of Rs. 1,206 has been collected during 1878, and the arrears for 1878 on 31st December are Rs. 1,302.

Among the Members who have been removed by death during the years, Mr. Francis Halsey of Sujanpore in the Punjab, deserves special mention. He died of typhoid fever in August last at Venice on his way to England. Connected with the Society for 15 years, he had been in frequent communication on a variety of useful subjects, some of which are recorded in the Proceedings. During more recent years he had turned his attention specially to silk and sugar cultivation in the Punjab, which promised to result favourably. Shortly before his departure from India he took an active part in the exhibition of silk cocoons held at Nurgpur in the Kangra district, and furnished the Government with a report thereon of considerable interest. The Society, many years ago, encouraged this industry when quite in its infancy, and awarded a medal to a native Zemindar in the Punjab, who had taken much interest in its promotion. "No unofficial gentleman," observes the Secretary to the Government of the Punjab, in a communication to the Government of India, Department of Revenue, Agriculture and Commerce, "has labored with more interest and success to improve the native industries of the Punjab, and his enlightened exertions for the improvement of the breed of cattle, the introduction of new staples, the development of sugar manufacture, the rearing of the silk-worm, and the manufacture of silk, have been, on many occasions, and in various reports, brought under the notice of the Government of India." On his last visit to Calcutta, in the early part of the year, he promised, as soon as he could command the necessary leisure, to contribute certain papers to the Journal, the result of his proceedings towards the development of the silk and sugar industries of the Punjab, which, had he been able to complete them, would no doubt have been interesting and useful.

The death of Mr. Sulpiz Kurz, Curator of the Herbarium of the Royal Botanic Garden, Calcutta, though he was not a member of the Society, cannot be omitted in this annual record. Mr. Kurz had on various occasions contributed papers to the Journal, and his latest, and most valuable, on the *Musaceæ*, published in Vol. V., Part 3, has been left unfinished by his untimely death, in January last, at Penang, whither he had proceeded in the hope of restoring his health. His botanical researches in the Malayan Archipelago, Burma and India, have been considerable. His death in the prime of life has deprived science of an unassuming but most ardent votary.

Work has been well attended to during the past year in the Garden. Applications for delivery orders (233) have been duly met. Besides these, many supplementary orders have been issued, a fact which shews that many Members have availed themselves of their privilege of indenting on the Garden. Of ornamental plants, 8,000 have been distributed to Members, and of economic plants 4,619, besides sales to Members and others of 2,500 fruit grafts, and 1,115 ornamental plants. The demand for Rose plants has been so great as almost to exhaust the old stock; and as this class of plants continues to be so popular, it is proposed to introduce next year (1879) a further stock of new varieties.

The Council have to express their obligations to various correspondents for donations to the Garden; among these may be mentioned the Queensland Acclimatisation Society; the Directors of the Botanic Gardens at Mauritius and Singapore, and Mr. T. M. Francis; and for seeds to Dr. King, of the Royal Botanic Garden, Calcutta, the Baron Ferdinand von Mueller of Melbourne, and Mr. H. E. Abbott of Tirhoot.

A flower show was held in the Garden, the first of the kind in this locality; and though it took place so late in the season as the 2nd of March, the collection of plants exhibited was tolerably fair, and the attendance of visitors, members and others, was large. The amount received by sale of tickets, at one rupee each, from the latter, almost sufficed to meet ordinary expenses. This was the first occasion on which a charge was made for admittance; but the innovation passed unobserved, or at least without objection. Ladies and children were admitted free.

Allusion was made in the last report to a very important subject, namely, blights of various kinds affecting the tea plant, and to the efforts which the Society were making to organize a full enquiry towards its thorough investigation. These efforts have been continued during the past year. Several Agents, largely interested, were quite willing to support the proposed scheme, provided others would join. As however these have failed to respond, the Society have been reluctantly compelled to abandon it altogether.

The demand for useful plants and seeds has been unusually large during the past twelve months and has been responded to to the best of the Society's ability. Among others may be recorded applications for tea and tobacco seeds from Rangoon, Arracan, and the Andamans; Bamia Cotton seed for the Bangalore Botanic Garden; seeds of various kinds from the Director, Department of Agriculture and Commerce, N.-W. Provinces, and from the Minister of Public Works in Egypt.

Various subjects of interest have been communicated and discussed during the year, more especially in respect to sericulture, flax cultivation for the sake of its fibre, manures for tea gardens,

the Arabian date palm *quoad* its cultivation in India, and the utilization of certain plants in times of scarcity, and several others, of which full particulars have been recorded in the monthly Proceedings.

Two parts of the Journal, 3 and 4 of Vol. V. have been published during the year, and Part 1. of Vol. VI. is now in the Press, and will probably be issued in the early part of 1879.

Statement of Receipts and Disbursements of the AGRICULTURAL AND HORTICULTURAL SOCIETY OF INDIA, from 1st January to 31st December, 1878.

RECEIPTS.

From Members' Subscriptions collected during the year	...	...	17,408	8	8
„ Proceeds of country vegetable, acclimated flower and other seeds	...	541 8 0	.	.	.
„ Proceeds of surplus stock of American vegetable, English, German, and French vegetable and flower seeds and Melbourne field seeds...	2,148 12 0	2,690 4 0			
„ Government—Proceeds of surplus stock of American vegetable and acclimated flower seeds and English vegetable and flower seeds specially imported for H. M.'s Soldiers' Gardens	...	1,050 0 0	3,740	4	0
„ Proceeds of copies of Journals of the Society..	19	8 0			
„ Proceeds of copies of other publications of the Society	...	95 4 6	114	12	6
„ Proceeds of 6 Bronze Medals of the Society..			18	0	0
„ Proceeds of Admission Tickets for non-Members to the Flower Show held in March ...	241	0 0			
And President's donation	25	0 0	266	0	6
„ Amount of freight repaid	...	...	549	14	3
„ Amount of suspense account in deposit for appropriation on various accounts	...	...	111	14	9
„ Amount of packing and forwarding charges on seeds, plants, &c.	...	...	2,489	14	3
„ Garden—Proceeds of fruit grafts	...	1,038 13 0			
Proceeds of ornamental plants	1,686	3 9	2,725	0	9
Proceeds of boxes, pots and Wardian cases		395 6 0			
Amount cooly-hire for packing plants, &c. &c.	...	81 2 6	3,201	9	3
Total, Ordinary Receipts, Rs.	...	...	27,895	18	6
EXTRAORDINARY RECEIPTS.					
From Government of Bengal—Donation from December 1877 to November, 1878	...	2,400 0 0			
„ H. E. the Viceroy, Donation	...	500 0 0			
„ Rent of large room of the Hall from May to November, 1878	...	700 0 0	3,600	0	0
Total, Rs.	...	...	31,495	18	6
Balance in the Bank of Bengal on 31st December, 1877	...	...	7,254	15	9
GRAND TOTAL, Rs.	...	...	38,750	13	3

DISBURSEMENTS.

SEED ACCOUNT.

By Messrs. D. Landreth and Sons, balance in full of their account for seeds received in 1877 ..	1,050	7	3
„ Messrs. Vilmorin Andrieux & Co., balance for consignments of seeds received in 1877 and in part for 1878 ..	1,462	13	8
„ Robert Buist, Jr., for ditto ditto ditto ..	2,438	1	6
„ Messrs. Sutton & Sons in part for do. do. in 1878 for account of the Society...	1,702	6	6
And in full for ditto imported for Government ...	735	11	0
	<hr/>	2,438	1 6
„ Messrs. Platz and Sons in part for consignment of seeds received in 1878 ..	1,828	9	2
„ W. Adamson in full for ditto ditto ditto ..	225	5	6
„ H. Cannell, for an assortment of flower seeds...	18	14	3
„ Messrs. Barr & Sugden ditto ditto ditto ..	27	9	0
„ Horticultural Garden, Oudh, on account ditto for acclimatised flower seeds ...	417	11	6
„ Sundry parties for country vegetable seeds, Pignuts, Impee, Tea, &c. &c. ...	298	1	0
	<hr/>	10,205	10 4

LIBRARY ACCOUNT.

„ Messrs. H. S. King & Co., for sundry publications ...	135	0	3
„ Sundry parties for books purchased ...	8	14	0
„ Duftry for binding books ...	36	6	0
	<hr/>	180	4 3

PRINTING ACCOUNT.

„ Messrs. T. Black & Co., for printing cash and subscriptions books, money receipts, annual reports, &c. ...	172	12	0
„ “Hope Press” for printing letters of call, labels, &c. ...	16	0	0
	<hr/>	188	12 0

FURNITURE ACCOUNT.

„ Sundry parties for repairing furniture	5	0 0
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ESTABLISHMENT ACCOUNT.

„ Office Establishment from December 1877 to November 1878	8,908	0 0
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ADVERTISEMENT ACCOUNT.

„ Advertising notices of Meetings, seeds for distribution, surplus seeds for sale, &c. &c.	113	2 0
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FREIGHT ACCOUNT.

„ freight paid on French seeds ...	35	9	0
„ freight paid on packages of seeds, plants, &c., sent to Members ...	617	11	0
	<hr/>	653	4

Rs. ... 20,254 0 7

Statement.

lvii

Brought forward ... 20,254 0 7

METCALFE HALL ACCOUNT.

By proportion of house rates from October 1877 to June 1878, and police, lighting, and water-rates from January to September 1878	...	...	434	4	0	.
„ Matting and sundry petty works to the Building	...	...	27	7	0	.
						461 11 0

STATIONERY ACCOUNT.

„ Sundry parties for stationery purchased	36	9	9
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REFUND ACCOUNT.

„ Amount refunded, balance of account due to Members	45	0	0
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JOURNAL ACCOUNT.

„ Messrs. T. Black & Co., for printing 750 copies each of Journal Vol. V., parts III and IV	1,263	14	0
„ Mr. S. Sedgfield for lithographing and printing Plates for Journal, Vol. V., Part III	...	...	144	8	0
					1,408 6 0

PUBLICATION ACCOUNT.

„ Messrs. T. Black & Co., for printing 300 copies of Indian Gardens and what to grow in them, 2nd Edition	230	0	0
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FLOWER SHOW ACCOUNT.

„ Prizes distributed to Mallees for exhibiting flowers	177	0	0
„ Advertizing, printing, carriage hire, and sundry expenses incurred	...	...	88	8	6
					265 8 6

PETTY CHARGES ACCOUNT.

„ Postage on letters, circulars, journals, &c.	...	...	218	2	0
„ Punkawallahs, hackery, boat, and cooly hire, extra porter, landing and forwarding charges, cost of wax-cloth, oil cloth, twine, tin-boxes for acclimated flower seeds, &c. &c.	...	...	422	9	0
					640 11 0
					Rs. ... 23,841 14 10

GARDEN ACCOUNT.

By cost of sundry materials for propagation of roses, fruit grafts, orchids, &c. ...	674	13	0		
„ Cost of tools, implements, boxes, pots and contingencies ...	1,150	14	3		
				1,825	11 3
„ Salary of Mr. Head, Head Gardener, from December 1877, to June 1878 ...	1,690	0	0		
„ Commission to ditto on sale of plants ...	119	6	3		
				1,809	6 3
„ Salary of Mr. Gleeson, Head Gardener, from June to November 1878 ...				1,200	0 0
„ Wages of Native Establishment, mallies, coolies, &c. ...				3,478	7 9
„ Messrs. Fleury & Co. advance for repairing Gardener's house ...				300	0 0
	Rs.			8,613	9 3

PLANT ACCOUNT.

„ Mr. Head, for consignment of plants taken over from him ...	1,909	0	0		
„ Sundry parties for fruit grafts, seedlings, &c. ...	67	7	7	1,976	7 7
					10,590 0 10
Total expenditure, Rupees ...					33,931 15 8
„ Balance in the Bank of Bengal on 31st December, 1878 ...					4,818 13 7
GRAND TOTAL, Rupees ...					38,750 13 3

LIST OF MEMBERS

OF THE

Agricultural and Horticultural Society

OF

INDIA.

DECEMBER 31st, 1879.

ALPHABETICALLY ARRANGED,

CLASSIFIED,

AND

DISTINGUISHING THE YEAR OF ADMISSION.

Office Bearers.

President :

THE HON'BLE LOUIS JACKSON, C. I. E.

Vice-Presidents :

**W. H. COGSWELL, Esq.
W. STALKARTT, Esq.**

**RAJAH SUTTYANUND GHOSAL
BAHADDOOR.
BABOO KALI PROSONNO GHOSE.**

Secretary and Treasurer :

A. H. BLECHYNDEN, Esq.

Members of Council :

**R. BLECHYNDEN, Esq.
BABOO PEARY CHAND MITTRA.
J. W. O'KEEFE, Esq.
DR. S. LYNCH.
W. WATERFIELD, Esq.
BABOO PROTAPA CHUNDR GHOSA.
J. E. MACLACHLAN, Esq.
DR. GEO. KING.
DR. J. B. BARRY.
S. H. ROBINSON, Esq.
H. J. LEITCH, Esq.**

Patron.

HIS EXCELLENCY THE RIGHT HON'BLE
EDWARD ROBERT LYTTON, BULWER-LYTTON, BARON
LYTTON OF KNEBWORTH, G. M. S. I.,
Viceroy and Governor-General of India.

List of Members.

* This mark denotes Members who are absent from India, and therefore non-contributors.

† This mark denotes Members, who, though absent, are desirous of continuing their subscriptions.

HONORARY MEMBERS.

	Don Ramon de la Sagra	Island of Cuba	...		
	The Right Hon'ble Sir Lawrence Peel,	London	1842	1856	
	R. Fortune, Esq.,	London	...	1856	
	A. Grote, Esq.,	London	...	1837	1868
5	The Revd. T. A. C. Fuminger,	London	...	1851	1868
	Baboo Peary Chand Mittra,	Calcutta	...	1847	1871
	John Scott, Esq.,	Howrah	...	1871	
	J. A. Crawford, Esq.,	London	...	1857	1874
	Lieut.-Genl. Sir Arthur Phayre,	G. C. M. G., K. C. S. I.,		1879	
10	Baron Ferdinand von Muellor	K. C. M. G., M. & Ph. D.,			
	F. R. S.	...	...	...	1879

CORRESPONDING MEMBERS.

	D. J. MacGowan, Esq., M. D.,	Ningpo	...	1851	
	Mons. Natalis Rondot,	Paris	...	1858	
	Lieut.-Col. W. H. Lowther	...	...	1864	
	Dr. H. Cleghorn,	Stravithie, St. Andrews, N. B.	...	1867	
15	Vause Fretwell, Esq.,	Supdt. of Model Farms at			
	Bhurgaums,	Kandeish	...	1869	
	C. Brownlow, Esq.,	Cachar	...	1870	
	Samuel Jennings, Esq.,	London	...	1874	

ASSOCIATE MEMBERS.

	Capt. E. P. Nisbet,	London	...	1842	
	Geo. Bartlett, Esq.,	Calcutta	...	1870	

LIFE MEMBERS.

Admitted.

20	Anund Rao Puar,	His Highness, the Rajah of Dhar,			
	Dhar, <i>via</i> Indore,	C. I. E.	...	1872	
	Bentall, * Edward, Esq.	...	...	1837	
	Bhopal, H. H. the Begum of	...	...	1870	
	Bhowany Sing, Maharajah,	Duttea	...	1864	
	Bishop, * Major H. P. (Artillery)	...	...	1853	

LIFE MEMBERS.—(Continued.)

	<i>Admitted</i>
25 Bishnath Sing, Rajah Bahadoor, Chief of Chutter- pore, Bundlekund	1875
Brodie,* Major T.	1836
Buller,* Frederic Pole, Esq.	1837
Carew,* B. R., Esq.	1846
Chhat Sing, Bahadoor, Maharajah of Samthar	1877
30 Chatter Patti Rao, Jagirdar of Alipoorah	1876
Colville,* Sir J. W.	1849
Gopaul Sing, Rajah of Jabooah, <i>via</i> Indore	1874
Joy Sing, Deo Bahadoor, Maharajah of Chikari	1868
Maharajah of Johore	1868
35 Manikjee Rustomjee, Esq., Merchant, Calcutta	1837
Mohender Pertab Singh, Maharajah, Bahadoor of Orcha, Tehri	1876
Muhamud Hussin Khan Bahadoor, Nawab-zada of Baonie	1877
Munsier Ali, H. H., The Nawab Nazim of Bengal	1874
Palmer,* T. A. G., Esq.	1861
40 Rajkissen Mookerjee, Baboo, Landholder, Oterparah	1836
Richards,* J., Esq., Merchant	1834
Roodurpurshand Chowdry, Nanpore, Tirhoot	1867
Roop Deo, Rajah of Ali-Rajpore, <i>via</i> Sirdarpore, c. 1.	1874
Roordur Purtab Sing, Rajah Bahadoor, Dewan of Punna	1868
45 Suttayanundo Ghosal, Rajah Bahadoor, Bhookoylas... ..	1869
Thompson, Dr. R. F., Hooghly	1865
Wigram,* Percy, Esq., c. s.	1871

ORDINARY MEMBERS.

A.

ABBOTT, Horace, Esq., Rajapore, <i>via</i> Koosteah	1858
Abbott, H. E., Esq., Manager, Jaintpore Factory, Tirhoot	1874
50 Abdool Gunny, Kajee, Nawab, Zemindar, Dacca	1860
Adkin,* H. A., Esq., Solicitor, Calcutta	1878
Ady, Charles, Esq., Merchant, Moulmein	1864
Agabeg, Thadeus, Indigo Planter, Baraset	1875
Ahmed, Dr. Z. A., Civil Surgeon, S. P. Doomka	1875
55 Aitchison, W., Esq., Manager, Dooloo Tea Garden, Cachar	1869
Ainslie, W. D., Esq., Russelcondah, Ganjam	1875
Alexander, N. Stuart, Esq., c. s., Mymensing	1864
Allen, J. J., Esq., Furka-ting, Golaghat, Assam	1877
Anderson, T., Esq., Merchant, Calcutta	1870

A.—(Continued.)

		<i>Admitted.</i>
60	Anderson, A., Esq., P. W. D., Dinagepore ...	1878
	Andrews, S. J., Esq., Gadee Zillah, Moorsshedabad...	1876
	Angelo, E., Esq., Cossipore...	1873
	Angelo, Major, R. F., B. S. C., Comdg at Chunar ...	1878
	Anthony, Adam, Esq., Deputy Accountant-General, Lahore ...	1870
65	Arbuthnot, The Hon'ble Sir A. J., K. C. S. I., Calcutta	1876
	Armstrong, Joseph Samuel, Esq., O. S., Pooree ...	1865
	Assistant Manager, Ting Ling Tea Co., Darjeeling...	1875
	Assistant Manager, Singbuli and Nurmah Tea Co., Limited, Darjeeling ...	1875
	Assistant Commissioner, Jhansi ...	1877
70	Atkinson, Alex., Esq., C. E., Etah ...	1877

B.

	BALKRISHNA, Rai, Benares ...	1878
	Banon,* Lieut. A., 39th N. I. ...	1877
	Bannerman,* Lt.-Col. P. W., Pol. Agent, Bhagelkund (Rewah) ...	1876
	Barber, H. W., Esq., Deputy Magistrate, Chittagong	1875
75	Barker, Dr. R. A., Civil Surgeon, Bogra ...	1870
	Barlow, G. N., Esq., Civil Service, Bhagulpore ...	1864
	Barron, Major W., Depy. Supdt, Revenue Survey, 4th or Moradabad District, Nynsee Tal ...	1871
	Barry, Dr. J. B., Calcutta ...	1877
	Barstow, H. C., Esq., Civil Service, Ghazipore ...	1868
80	Battersby,* Dr. W. E., Supdt. Central Jail, Bhagul- pore ...	1878
	Beadon, R. B., Esq., Hopjaun Porbot, Jaipore, Luckimpore, Assam ...	1879
	Bean, Mrs. E., Bankipore ...	1877
	Beaumont, Dr. Thomas, Residency Surgeon, Indore	1870
	Beckett, H. B., Esq., Depy. Commissioner, Dehra Ghazekhan ...	1876
85	Becby, G. O., Esq., Solicitor, Calcutta ...	1866
	Behari Lall Pyne, Baboo, Calcutta ...	1876
	Benwell, W. M., Esq., Calcutta ...	1876
	Beveridge, H., Esq., C. S., Bankipore ...	1865
	Bhugwan Chunder Bose, Baboo, Deputy Magistrate, Cutwa ...	1875
90	Bignell, R. A. D'O., Esq., Assistant Superintendent of Police, Patna ...	1867
	Bimala Churn Bhattacharjee, Deputy Collector and Magistrate, Gya ...	1870
	Binning, J., Esq., Calcutta ...	1877
	Blechynden, R., Esq., Merchant, Calcutta ...	1858

3.—(Continued.)

Admitted.

	Blechynden, A. H., Esq., Secretary, Agri-Hort. Society of India, Calcutta	...	...	1851
95	Blyth, W. D., Esq., c. s., 24- Pergunnahs	...	...	1876
	Boddam, Col., Hungerford, Hazareebaugh	...	...	1871
	Boerresen, The Rev. H. P., Nya Doomka	...	...	1879
	Bonnaud, Arthur, Esq., Merchant, Calcutta	...	...	1873
	Bowers, Mrs., Bhuptani, Protanbgunge, Bhargulpore	...	...	1872
100	Bowser, Dr. H. C., Calcutta	...	...	1876
	Boxwell,* J., Esq., c. s.	...	...	1874
	Brae, T., Esq., Munjapara, Pubna	...	...	1854
	Brander,* James, Esq., E. B. Railway	...	...	1865
	Brandis, Dr. D., Inspector-General of Forests	...	...	1874
105	Branson, J. H., Esq., <i>Barrister-at-Law</i> , Calcutta	...	...	1874
	Brett, A. C., Esq., c. s., Jessore	...	...	1879
	Bridgman, J. H., Esq., Gornuckpore	...	...	1868
	Brodhurst, M., Esq., Civil Service, Benares	...	...	1859
	Brookes, O. H., Esq., Settlement Officer, Port Blair	...	...	1879
110	Broucke, W. J., Esq., Indigo Planter, Bhugha Factory, <i>vid</i> Chumparun	...	...	1859
	Brown, Forbes Scott, Esq., Merchant, Penang	...	...	1840
	Brown, H. F., Esq., Merchant, Calcutta	...	...	1875
	Browne, Lord Ulick, Civil Service, Rajshahye	...	...	1876
	Bruce, H. W., Esq., Tea Planter, Tezpore, Assam...	...	...	1876
115	Buck, E. C., Esq., c. s., Cawnpore	...	...	1870
	Buckingham, J., Esq., Manager, Amjoorie Tea Estate, Assam	...	...	1879
	Butler, Walter, Naga Doolia Factory, Jorehaut, Assam	...	...	1858

C.

	CALDWELL, Jas., Esq., Emigration Agent, Natal, Garden Reach	1878
	Campbell,* D. W., Esq., Locomotive Supdt., E. I. Railway, Jamalpore	...	...	1870
120	Campbell, Lt.-Col. A. E., Depy. Commissioner, Seeb-saugor, Assam	...	...	1879
	Campbell, W. A., Esq., Manager, Sungoo River Tea Plantation, Chittagong	...	...	1874
	Cantonment Magistrate, Cawnpore	...	...	1873
	Cantonment Magistrate, Lucknow	...	...	1876
	Carleton, C. F., Esq., Indigo Planter, Sathee Bettiah, Chumparun	...	...	1868
125	Carew, B. H., Esq., Damdin, Julpigoree	...	...	1879
	Carnac, H. Rivett, Esq., c. s. Ghazespore	...	...	1869
	Carshore, Walter B., Nunniah Factory, Shapore, Oonde, <i>vid</i> Bajitpore, T. S. Railway	...	...	1875
	Chamaretti, A., Esq., Surveyor-Genl.'s Dept., Calcutta	...	...	1874

C.—(Continued.)

		Admitted.
	Chambers,* Chas., Esq. ...	1878
130	Chapman, A. W., Esq., Broker, Calcutta	1877
	Charriol,* F., Esq., Merchant	1875
	Cheetham,* W. H., Esq., Merchant	1870
	Chief of Kagul, Kagul, near Kolapore	1879
	Chrestien, E., Esq., Bugha, Chumparun	1875
135	Chunder Caunt Mookerjee, Baboo, Calcutta	1866
	Chunder Kirtee Singh, Maharajah of Munnipore	1874
	Clarke, The Hon'ble Sir A., K. C. M. G., C. B.	1876
	Cogswell, W. H., Esq., Calcutta	1866
	Cole, Rev. J., Supdt. Lawrence Asylum, Sanawur, near Kussowlie	1865
140	Collier, F. R. S., Esq., c. s., Kurigann, Rungpore, Chumparun	1875
	Conroy, G. H. W., Esq., Calcutta	1879
	Cooke, Robin, Esq., Doolubcherra, Cachar	1878
	Coombe, Dr. F. S., Khagoul, Dinapore	1877
	Cooper, Dr. A. D., Civil Medical Officer, Naga Hills	1876
145	Cornell, W., Esq., Civil Service, Midnapore	1861
	Corse-Scott, Capt. J., 37th N. I., Bareilly	1876
	Coxhead,* T. E., Esq., c. s., Moorshedabad	1875
	Creaton, W. E., Esq., Merchant, Calcutta	1875
	Cresswell, W. S., Esq., Merchant, Calcutta	1874
150	Crowdy, L. J., Esq., Munjowl Factory, Beguserai, Monghyr	1875
	Crosthwaite, R. J., Esq., B. A., c. s., Offg. Judicial Commr., Burmah, Rangoon	1869
	Cunningham, the Hon'ble H. S.	1878
	Currie, G. M., Esq., Civil Service, Motihari, Chum- parun	1868
	Dalbusset,* E., Esq., Merchant, Calcutta	1871
155	Dalgairns, Dr. A. E., 7th Regt, M. N. I., Berhampore	1879
	Dalgliesh, E. W., Esq., Tea Planter, Dulsing Serai, Tirhoot	1878
	Dallas, J. P., Esq., Doars Tea Coy., Julpigoree	1877
	Daly, F. D., Esq., Manager, Simla Bank, Umballa	1867
	Darwood, J. M., Esq., Rangoon	1878
160	David, M., Esq., Dacca	1878
	Davies,* A., Esq.	1874
	Davis, C. T., Esq., Solicitor, Calcutta	1874
	Davis, W. P., Esq., Bengal Police, Hooghly	1870
	Davis, Major R. P., Dist. Supdt. Police, Bhaugulpore	1877
165	Davidson, James, Esq., Debrooghur, Assam	1870
	Dear, Herschel, Esq., Monghyr	1860

D.—(Continued.)

		Admitted.
	Deas, C., Esq., Calcutta ...	1874
	Denham, C. H., Esq., c. s., Howrah ...	1874
	Deputy Commissioner of Sumbulpore ...	1866
170	Deputy Commissioner of Ellichpore ...	1869
	Deputy Commissioner of Woon ...	1869
	*Deputy Commissioner of Bassim, West Berar ...	1871
	Deputy Commissioner of Akola, Berar ...	1875
	Desaran,* Edwd. Dubois, Esq., Aurungabad Factory, <i>vid</i> Pakour ...	1874
175	DeSouza, The Hon'ble Sir W. E., Consul-Genl. for Portugal, Calcutta ...	1878
	Dignam, S., Esq., Solicitor, Calcutta ...	1876
	Dickens, P., Esq., c. s., Nuddea ...	1879
	District Engineer, Mozufferpore, Tirhoot ...	1879
	Dodsworth, H. F. L., Esq., Oorjee Factory, Azimgurh ...	1879
180	Dodgson, W., Esq., Kallygunge Factory Rungpore ...	1864
	Dombal, Richard De, Esq., Manager, Hybutnugga Estate, Kisharegunge, Mymensing ...	1872
	Dombal, M. E., Durup-de, Esq., Mymensing ...	1876
	Doyal Chund Dass, Baboo, Banian, Calcutta ...	1877
	D'Silva, E. A., Esq., Asst. Dispensing Chemist, Calcutta ...	1873
185	Dunn,* Lieut. T. D. W., 62nd Regt. ...	1873
	Dwarka Nath Dutt, Baboo, Calcutta ...	1874

E.

	EDEN, Hon'ble Sir A., Lieut-Govr., Bengal, Alipore ...	1873
	Edgar, E. L., Esq., Cachar ...	1872
	Egerton, Hon'ble Sir R. E., Lieut-Govr., Punjab, Lahore ...	1864
190	Eisenlohr,* F., Esq., Merchant, Calcutta ...	1870

F.

	Firth, H. A., Esq., Emigration Agent, British Guiana, Calcutta ...	1873
*	Fisher, Lieut-Col. G. B., Commandant, Fort Shabkodar, Peshawur ...	1865
	Fisher, J. H., Esq., c. s., Meerut ...	1871
	Foley, W., Esq., Tea Planter, Sylhet ...	1877
195	Forbes, A., Esq., Calcutta ...	1878
	Francis, T. M., Esq., Solicitor, Mozufferpore, Tirhoot ...	1871
	Franklin,† Major W., 2-14th Regt., Lucknow ...	1879
	Fraser, Ronald, Manager, Margaret's Hope Tea Estate, Hope Town, Darjeeling ...	1875
	Furrock Shah, Prince Mohammed, Russapugla ...	1879

G.

200	GALE,* M. H. L., Esq.	...	...	1873
	Gannon, J., Esq., Lucknow...	...	...	1879
	Garbett, Major C. H., Asst. Commr., Chaibassa, Singbhoom	...	...	1868
	Gardner, D. M., Esq., Civil Service, Banda	...	...	1872
	Gardner, E. B., Dr., Civil Surgeon, Shajehanpore...	...	...	1876
205	Garth, Hon'ble Sir Richard, Chief Justice, High Court, Calcutta	...	...	1875
	Gibbon, T. M., Esq., Betteah	...	...	1874
	Gibbon, W. F., Esq., Senr., Doolha Factory, Gorruck- pore	...	...	1870
	Gibbon, W. F., Esq., Turcoolah, Chumparun	...	...	1874
	Gilman, J. H. S., Sonapore Tea Factory, Gowhatty	...	...	1874
210	Glass, J., Esq., Ex.-Engineer, D. P. W., Jubbulpore	...	...	1836
	Gocool Nath Chatterjee, Baboo, Calcutta	...	...	1874
	Goonendro Nath Tagore, Baboo, Zemindar, Calcutta	...	...	1872
	Gopeenath Roy, Baboo, Calcutta	...	...	1871
	Gordon, D. T., Esq., Surdah	...	...	1859
215	Gordon, John, Esq., Bank of Bengal, Calcutta	...	...	1865
	Gordon,† Capt., A. Evans, Depy. Commr., Hill Tracts, Chittagong	...	...	1879
	Gordon, J. M., Esq., Hissar...	...	...	1879
	Grahame, Wm. Francis, Esq., M. C. S., Berhampore, Madras Presdy.	...	...	1871
	Grant, * Thomas, Esq., Indigo Planter	...	...	1848
220	Grant, G. H., Esq., Indigo Planter, Bhangulpore	...	...	1859
	Grant, C., Esq., Lebong, Darjeeling	...	...	1864
	Grant, W. St. Clair, Esq., Lortipore Concern, Bhan- gulpore	...	...	1879
	Gray, Dr. E., Jorehaut, Assam	...	...	1875
	Grey, E., Esq., Civil Service, Gya	...	...	1868
225	Grey, Lieut. Henry, Loharduga	...	...	1878
	Greeshchunder Mookerjee, Baboo, Calcutta	...	...	1879
	Grieff, J. C., Esq., Banikhet	...	...	1879
	Grija Prosunno Mookerjee, Baboo, Zemindar, Geber- danga	...	...	1878
	Greenhill, T., Esq., Calcutta	...	...	1877
230	Grierson, G. A., Esq., C. S., Durbhangah	...	...	1877
	Griffiths, Ralph, Esq., Allahabad	...	...	1870
	Grimley, J. E., Supt. Nizam's Garden, Hyderabad	...	...	1875
	Grimwood, F. St. C., Esq., C. S., Sebsaugor, Assam	...	...	1878
	Groundwater, R., Esq., Tea Planter, Gowhatty, Assam	...	...	1875

H.

235	HADENFELDT,* R., Esq., Merchant	...	...	1874
	Haines, H. E. Genl. Sir F. P., C. C. B., Commander-in- Chief	...	...	1878

L.—(Continued)

Admitt

	Lachmepat Sing, Roy, Bahadoor, Banker, Calcutta	18
	Lachmessur Sing, Bahadoor, Zemindar, Durbungah, Tirhoot	18
	Lakin,* Major F., 3rd Hussars	18
310	Lushington, H., Esq., c. s., Allahabad	186
	Lyall, D. R., Esq., Civil Service, Howrah	186
	Lyall, B. A., Esq., Merchant, Calcutta	187
	Lynam, John, Esq., Supdt. Reserve Police Force, Calcutta	186
	Lynch, Dr. Sydney, Health Officer, Calcutta	187
315	Lyon, Geo. Kennett, Esq., c. s., Rungpore	187

M.

	MACALLISTER, R., Esq., Merchant	187
	MacBean, Duncan, Esq., Paror Tea Estate, Kangra Valley	187
	Macdonald, James, Esq., c. s., Allyghur	187
	Mackay, G. R. Aberigh, Esq., Principal, Residency College, Indore	187
320	Mackenzie, W. S., Esq., Jutwanpore, Soonastipore, Tirhoot	187
	Mackillican, J., Esq., Merchant, Calcutta	186
	Mackinnon, D., Esq., Merchant, Calcutta	187
	Mackinnon, John, Esq., Merchant, Calcutta	187
	Mackintosh, A., Esq., Dooria Factory, Tirhoot	187
325	MacLachlan, J. E., Esq., Merchant, Calcutta	186
	Maclean, Hon'ble A. T., Civil Service, Calcutta	185
	Macmillan, J., Esq., c. s., Cuttack	186
	Macnamara, J. A., Esq., c. s., Dist. Engineer, Shahabad	187
	Macpherson, W., Esq., Civil Service, Cuttack	1861
330	Maddock, H. R., Esq., Tea Planter, Chittagong	1877
	Maharajah of Betteah, Tirhoot	1870
	Maharajah of Cooch Behar	1864
	Maharajah (Coomar) of Vizianagram	1879
	Mahony, H. C., Esq., Tooklai Facky, Jorehaut, Assam	1879
335	Manager, Amluckee Tea Company, Assam	1877
	Manager, Arcuttipore Tea Co., Cachar	1879
	Manager, Awah Estate, Awahgurh, Agra District	1879
	Manager, Balasun Tea Co., Darjeeling	1875
	Manager, Bengal Tea Company, Cachar	1867
340	Manager, Bishnath Tea Co., Assam	1875
	Manager, Borelli Tea Co., Assam	1878
	Manager, Borsillah Tea Co., Assam	1875
	Manager, Brahmapootra Tea Co., Assam	1875
	Manager, Burrumsal Garden, Sylhet	1876
345	Manager, Boroomcherre Tea Garden, Cachar	1878

M.—(Continued.)

		Admitted
	Manager, Central Cachar Tea Co. ...	1875
	Manager, Central Terai Tea Co., Darjeeling ...	1875
	Manager, Chenga Tea Association, Darjeeling ...	1875
	Manager, Chincoorie Tea Co., Cachar ...	1875
350	Manager, Chumta Tea Association, Darjeeling ...	1875
	Manager, Chunderpore Tea Garden, Assam ...	1875
	Manager, Chundypore Tea Company, Cachar ...	1862
	Manager, Cutlee Cherra Garden, Cachar ...	1865
	Manager, Dahingepore Factory, Assam ...	1865
355	Manager, Darjeeling Tea and Cinchona Association, Darjeeling ...	1879
	Manager, Durrung Tea Company, Assam ...	1877
	Manager of Dewkonall Estate, Cuttack ...	1871
	Manager, East India Tea Company, Assam ...	1865
	Manager, East India Tea Company, Cachar ...	1860
360	Manager, Elambazar Indigo Concern, Bhulpore ...	1877
	Manager, Gellhutting Tea Estate, Assam ...	1877
	Manager, Giell Tea Co., Darjeeling ...	1875
	Manager, Goomrah Factory, Tirhoot ...	1865
	Manager, Government Garden, Fyzabad, Oudh ...	1871
365	Manager, Government Garden, Gondah, Oudh ...	1875
	Manager, Greenwood Tea Garden, Assam ...	1875
	Manager, Halmara Tea Estate, Assam ...	1870
	Manager, Hattigor Tea Estate, Mungledye, Assam ...	1879
	Manager, Hoelmaree Tea Co., Assam ...	1875
370	Manager, Hoolungurree Tea Co., Assam ...	1878
	Manager, Jokie (Assam) Tea Co., Assam ...	1875
	Manager, Julnacherra Tea Garden, Cachar ...	1875
	Manager, Joypore Garden, Cachar ...	1865
	Manager, Kaliabar Tea Estate, Assam ...	1876
375	Manager, Kallacherra Tea Company, Cachar ...	1862
	Manager, Kallian Tea Garden, Cachar ...	1874
	Manager, Kamptee Gwallie Tea Estate, Debrooghur ...	1875
	Manager, Kanchunpore Tea Company, Cachar ...	1862
	Manager, Kassomaree Tea Garden, Assam ...	1875
380	Manager, Kobira Tea Estate, Mungledye, Assam ...	1877
	Manager, Koeyah Factory, Cachar ...	1865
	Manager, Koomtar Tea Garden, Assam ...	1869
	Manager, Lalla Mookh Tea Garden, Cachar ...	1875
	Manager, Lallacherra Garden, Cachar ...	1879
385	Manager, Luckimpore Tea Co., Assam ...	1875
	Manager, Luckwah Tea Garden, Assam ...	1875
	Manager, Majagram Tea Co., Cachar ...	1875
	Manager, Majulighur Tea Estate, Assam ...	1875
	Manager, Mandakatta Tea Estate, Assam ...	1875
390	Manager, Monacherra Tea Garden, Cachar ...	1875

—(Continued.)

Admitted

	Manager, Moran Tea Co., Seeksangor, Assam	...	1875
	Manager, Margaret Hope Tea Plantation, Darjeeling		1876
	Manager, Masempore Tea Garden, Cachar	...	1875
	Manager, Mettegurrah Tea Concern, Darjeeling		1877
395	Manager, Mesia Jan Tea Estate, Debrooghur		1875
	Manager, Munguldye Tea Co., Assam	...	1875
	Manager, Muttuk Tea Co., Assam	...	1878
	Manager, Narainpore Garden, Cachar	...	1865
	Manager, Noakacharee Tea Company, Assam		1865
400	Manager, Noobaree Tea Estate, Assam		1878
	Manager, Nuddea Ward's Estate, Kishnaghur		1875
	Manager, Pattareah Tea Co., Sylhet	...	1875
	Manager, Phoenix Tea Co., Cachar	...	1878
	Manager, Piakpara Estate, Piakpara, near Calcutt		1879
405	Manager, Punkabaree Tea Co., Punkabaree		1878
	Manager, Roopacherra Tea Garden, Cachar		1875
	Manager, Scottish Assam Tea Co., Assam		1875
	Manager, Selong Tea Estate, Shillong		1867
	Manager, Silcoorie Tea Garden, Cachar		1875
410	Manager, Singbulli and Nurmah Tea Co., L		
	Darjeeling	...	1875
	Manager, Singell Tea Company, Darjeeling		1874
	Manager, Sissobari Garden, Julpigoree		1877
	Manager, Sonai Tea Co., Cachar		1877
	Manager, Springside Tea Garden, Kurseong		1875
415	Manager, Tarrapore Tea Garden, Cachar	...	1871
	Manager, Teendarea Tea Company, Darjeeling	...	1874
	Manager, Teesta Valley Tea Association, Darjeeling		1875
	Manager, Terihannah Tea Plantation, Darjeeling	...	1876
	Manager, Tingri Tea Estate, Assam	...	1875
420	Manager, Tukvar Tea Co., Darjeeling		1878
	Masters, C. C., Esq., <i>Barrister-at-Law</i> , Bankipore.		1878
	Mandelli,* L., Esq., Tea Planter	...	1868
	Manook, Dr. S. J., Civil Surgeon, Chyebassa		1866
	Martin, John, Esq., Calcutta	...	1874
425	McFarlane, A. C., Esq., Merchant, Calcutta		1870
	McIntosh, A. R., Esq., Merchant, Calcutta	...	1872
	Meeville,* S. S., Esq., C s.	...	1875
	Mess Secretary, 42nd Assam Light Infantry, Shillong		1877
	Mess Secretary, 44th N. I., Shillong	...	1878
430	Mengens, J. G., Esq., Merchant, Calcutta	...	1865
	Mewburn, G. F., Esq., Merchant, Calcutta	...	1874
	Meyer, H., Esq., Cootahi Factory, <i>via</i> Baraich,		
	Goruckpore	...	1879
	Miches,* P., Esq.	...	1875
	Miller, Col. F. J., Goordaspore	...	1869

M.—(Continued.)

435	Minchin, F. J. V., Esq., Aska, Ganjam	...	1863
	Mitchell, R. W. S., Esq., Emigration Agent for Trinidad, 9, Garden Reach	...	1875
	Mohendrolall Khan, Koomar, Narajole, Midnapore	...	1871
	Moore, C. W., Esq., c. s., Mirzapore	...	1865
	Moran, F. C., Esq., Woodbine Factory, Debroghur, Assam	...	1870
440	Morris, E., Esq., Manager, Hong-Kong and Shanghai Banking Corporation, Calcutta	...	1874
	Morris, G. G., The Honorable, Civil Service, Judge, High Court, Calcutta	...	1872
	Mosely, T. H., Esq., Merchant, Calcutta	...	1863
	Mosley, L., Esq., Doars Tea Co., Julpigoree	...	1879
	Mullen, Dr. T. French, Residency Asst. Surgeon, Ulwar, Rajpootana	...	1871
445	Murray, J. L. K., Esq., Higli Mari Garden, Nowgong	...	1876
	Murray, J. C., Esq., Calcutta	...	1879

N.

	NARAYAN Rao, Maharajah of Dewass, Indore	...	1874
	Nassiruddeen Ahmed Moulvi, Behar	...	1876
	Narendra Narain Roy, Baboo, Jemooah Khandi, Moorshedabad	...	1879
450	Narsing Row, Zemindar, Vizagapatam	...	1879
	Neish, F. D., Esq., Ramoo Tea Estate, Chittagong	...	1879
	Newson, W. H., Esq., Merchant, Calcutta	...	1876
	Newton, E., Esq., Pleader, Allahabad	...	1879
	Newton, W. H., Esq., Merchant, Calcutta	...	1875
455	Nickels, C., Esq., Indigo Planter, Pesewa Factory, Jounpore	...	1866
	Nilladhur Sing Deo Bahadoor, Feudatory Chief of Killa, Sonopore	...	1874
	Nobin Chand Bural, Baboo, Solicitor, Calcutta	...	1874
	Nogendra Nath Mullick, Baboo, Zemindar, Andool	...	1877
	Nolan, Phillip, Esq., Civil Service, Tipperah	...	1873
460	Noor Khan, Huzrut, Minister of Jowrah	...	1871
	North, W. M., Esq., Bogracote Tea Estate, Silligoree	...	1879
	Nottobur, Sing, Raja, Chowdry-bazar, Outtack	...	1879
	Nundlall Bose, Baboo, Zemindar, Calcutta	...	1875

O.

	OBHOYCHURN GOHO, Baboo, Merchant, Calcutta	...	1856
465	Odling, C. W., Esq., c. e., Arrah	...	1871
	O'Donoghue, C. R., Esq., Pattarlong Tea Estate, Darjeeling	...	1878
	O'Keefe, J. W., Esq., Merchant, Calcutta	...	1871

O.—(Continued)

	Oldfield, R. C., Hon'ble, c. s., Allahabad	...	1875
	Oldham, Wilton, Esq., L. L. D., Civil Service, Doomka	...	1867
470	Omesh Chunder Dutt, Esq., Calcutta	...	1874
	Orr, Major Alexander P., Roy Bareilly, Oudh	...	1868
	Osborne, Col. Willoughby, F. E. G. S., F. G. S., Bhurtpore	...	1862
	Osborne, Lt.-Col. J. H. Willoughby, Cawnpore	...	1870

P.

	PARCELL, W. G., Esq., Dehing Tea Co., Assam	...	1877
475	Peal, S. E., Esq., Tea Planter, Sapakatee, Seebangor, Assam	...	1867
	Peel, Fredk., Esq., Merchant, Calcutta	...	1871
	Peppè, G. T., Esq., Ranchee	...	1872
	Peppè, T. F., Esq., Arrah	...	1868
	Peppè, W., Esq., Birdpore, Gorruckpore	...	1875
480	Perrin, Monsr. J., Silk Filatures, Berhampore	...	1859
	Phillips, J., Esq., Manager, Government Farm, Allahabad	...	1875
	Phipps, S. U., Esq., Calcutta	...	1874
	Pickance, * Capt. W. John, Madras Staff Corps	...	1867
	Piggot, William, Esq., Broker, Calcutta	...	1864
485	Pinney, G. F., Esq., Rangajan Factory, Jorehaut, Assam	...	1871
	Pirie, A. H., Esq., Canning College, Lucknow	...	1879
	Plowden, * W. C., Esq., c. s.	...	1876
	Pocock, R. J. M., Esq., District Superintendent of Police, Etawah	...	1877
	Pogson, Capt. J. F., Simla	...	1879
490	Political Agent for Supdt., Rajkumar College, Bunderkund	...	1876
	Pooroo Chunder Roy, Rajah, Zemindar, Sarapooly	...	1870
	Pott, A. C., Esq., Merchant, Calcutta	...	1878
	Prannath Pundit, Baboo, Bhowanipore	...	1877
	Pratap Chundra Ghosa, Baboo, Calcutta	...	1869
495	Prentiss, Dr. C., Goruckpore	...	1878
	Preo Nath Sett, Baboo, Calcutta	...	1876
	Pringle, R. B., Esq., Badalipur Tea Garden, Assam	...	1870
	Princep, the Hon'ble H. T., Calcutta	...	1879
	Protheroe, Major Montague, Dy. Supdt., Port Blair	...	1869
500	Prosonno Coomar Banerjee, Baboo, Calcutta	...	1871
	Pyne, R., Esq., Putalpole, Silligoori	...	1867

Q.

	QUINTON, J. W., Esq., Civil Service, Jhansi	...	1865
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		Admitted
	Ramaymohun Chowdry, Rai Bahadoor, Zemindar, Rungpore ...	1866
	Ram Rungan Chuckerbutty, Rajah Bahadoor, Hetampore ...	1871
505	Rampini, R. F., Esq., C. S., Dacca ...	1871
	Ramsay, Herbert, Esq., Tea Planter, Kurseong ...	1871
	Ravenshaw, T. E., Esq., Civil Service, Chinsurah ...	1866
	Rayson, J., Esq., Manager, Behpara Tea Garden, Debrooghur ...	1871
	Reed, F. T., Esq., Hetampore, Beerbhoom ...	1871
510	Reid, J. R., Esq., C. S., Bareilly ...	1866
	Reilly, Herbert, Esq., Depy. Magistrate, Maldah ...	1871
	Richards, Vincent, Dr., Goalundo ...	1871
	Ritchie,† D. W., Esq., Offg. District Supt. of Police, Chyebassa ...	1871
	Roberts, C., Esq., Kurseong, Darjeeling ...	1878
515	Robinson, S. H., Esq., Merchant, Calcutta, Vice-President ...	1854
	Romesh Chunder Mittra, the Hon'ble, Calcutta ...	1874
	Rose, R., Esq., Inspector Postal Department, Dacca ...	1877
	Rowett, R., Esq., Merchant, Rangoon ...	1877
	Ruddock, E. H., Esq., B. C. S., Jessore ...	1868
520	Runglall Sing, Baboo, Bhangulpore ...	1876
	Rushton, H. P., Esq., Merchant, Calcutta ...	1879
	Russell, T. M., Esq., Merchant, Calcutta ...	1868

S.

	SAGORE DUTT, Baboo, Merchant, Calcutta ...	1855
	Samachurn Law, Baboo, Merchant, Calcutta ...	1850
525	Samanand De, Babadoor Rai, Balasore ...	1875
	Samuells, W. L., Major, Asst. Commr., Loharduga ...	1875
	Sanders, Dr. R. C., Moradabad ...	1875
	Sandays, Edwin F., Esq., Chittagong ...	1877
	Scarth, Edward, Esq., Ningri Ting Tea Factory, Assam ...	1878
530	Sceales, Jaffray O'Brien, Esq., Rancoora ...	1869
	Secretary, Assam Company, Calcutta ...	1865
	Secretary, Cantonment Public Garden, Agra ...	1865
	Secretary, Cantonment Fund Committee, Morar ...	1878
	Secretary, Local Funds, Raepore ...	1874
535	Secretary, Local Fund Committee, Ferozepore ...	1861
	Secretary, Local Fund, Nimar, Khundwa ...	1873
	Secretary, Local Committee, Betul ...	1874
	Secretary, Municipal Committee, Mirzapore ...	1869
	Secretary, Municipal Committee, Prome ...	1876
540	Secretary, Municipal Committee, Goruckpore ...	1877

S.—(Continued.)

		Admitted.
	Secretary, Municipality of Mau, Banipore, Jhansi ...	1878
	Secretary, Public Garden, Azimghur ...	1871
	Secretary, Public Garden, Banda ...	1855
	Secretary, Public Garden, Jaloun, Oorai ...	1866
545	Secretary, Public Garden, Benares ...	1875
	Secretary, (Hony.) Planter's Club, Mozufferpore ...	1877
	Secretary, Public Garden, Rungpore ...	1877
	Secretary, Public Garden, Nowgong, Bundlekhund... ..	1877
	Secretary, Queen's Garden, Delhi ...	1873
550	Sells, A., Esq., c. s., Mozuffernuggur ...	1874
	Shaw*, Dr. John Cardy ...	1873
	Shabiuddin, Shaik, Nowada, Behar ...	1878
	Sheoraj Sing, Rajah, c. s. i., Kasipore, Naineetal ...	1877
	Sheo Pertab Narain, Baboo, Pleader, Chuprah ...	1879
555	Sherlock, J. E., Esq., Calcutta ...	1878
	Sherriff, W., Esq., Jorroda, Jessore ...	1859
	Shillingford, J. L., Esq., Kolassy Factory, Purneah ...	1865
	Shillingford, G. W., Esq., Kolassy Factory, Purneah ...	1867
	Showers, A. C., Esq., Noakacherra, Upper Assam ...	1879
560	Showers, St. Geo. A., Esq., Cinnamara Factory, Jorehaut, Assam ...	1875
	Shumsheer Jung, Nawab, Hyderabad ...	1878
	Simons, C. J., Esq., Tea Planter, Dahingapore Factory, <i>vid</i> Jorehaut, Assam ...	1863
	Simson, James, Esq., Civil Service, Allahabad ...	1856
	Skinner, A., Esq., Mussoorie ...	1854
565	Sladen,* J., Esq., c. s. ...	1876
	Smallwood, A. E., Esq., Broker, Calcutta ...	1875
	Smith, Dr. H. S., Civil Surgeon, Allahabad ...	1875
	Smith,* Maxwell, Esq. ...	1869
	Smith, W. E., Esq., Dickhora Garden, Nowgong, Assam ...	1875
570	Smith, W., Esq., Dorunda Factory, Chota Nagpore... ..	1872
	Smith, W. M., Esq., Nya Doomka, S. Pergunnahs ...	1878
	Sorabji Dadabhoy, Mr., Patell, Mhow.	1879
	Sparks, H. J., Esq., c. s., Rai Bareilly ...	1876
	Spencer, Harrison, Esq., Tea Planter, Darjeeling ...	1874
575	Sri Mohun Thakur, Baboo, Berarie, Bhanguipore ...	1877
	Stalkartt,† William, Esq., Merchant, Calcutta, Vice-President ...	1845
	Stalkartt, J., Esq., Hope Town, Darjeeling ...	1863
	Staunton, R. S., Esq., Calcutta ...	1878
	Steel, Octavius, Esq., Merchant, Calcutta ...	1874
30	Steel, Donald, Esq., Eastern Cachar Tea Company, Cachar ...	1861
	Stevens*, C. C., Esq., Civil Service ...	1875
	Stevens, H. W., Esq., Supdg. Engr., Durbhangah ...	1867

S.—(Continued.)

		Admitted.
	Stevenson, Geo., Esq., Civil Service, Balasore ...	1872
	Stewart, R. D., Esq., Julpigoree ...	1872
585	Stokes, Allen, Esq., E. I. Railway, Jamalpore ...	1867
	Stokoe, T. R., Esq., Barrister, Calcutta ...	1878
	Stone, C. G., Esq., Bokahala Factory, Jorehaut, Assam ...	1875
	Stratton, J. P., Esq., Political Agent, Nowgong, Bundelkhund ...	1873
	Studd, E. J. O., Esq., Dhoolea Factory, Tirhoot ...	1875
590	Sturmer, A. J., Esq., Talooka Rajah, Cheriakote, P. O. Zumaneah ...	1866
	Sukharam Martand, Esq., Indore ...	1872
	Sumbhoo Narayana, Rajah Bahadoor, Benares ...	1872
	Superintendent, Govt. Model Farm, Cawnpore ...	1875
	Superintendent, Rambagh, Umritsur ...	1859
595	Superintendent, Taj Garden, Agra ...	1874
	Superintendent of the Patna Lunatic Asylum, Patna ...	1872
	Superintendent, Central Prison, Benares ...	1871
	Superintendent of Jorehaut Tea Company, Assam ...	1865
	Superintendent, Serajgung Jute Compy., Serajgung ...	1868
600	Seperintendent, European Lunatic Asylum, Calcutta, Bhowanipore ...	1878
	Superintendent, Nuddea Jail, Kishnaghur ...	1878
	Superintendent, Botanical Gardens, Saharnpore ...	1878
	Superintendent, Government Horticultural Garden, Lucknow ...	1879
	Sardharee Lal, Baboo, Zemindar, Bhaugulpore ...	1874
605	Suraj Deb Narain Sing, Baboo, Balgarh, Tirhoot ...	1879
	Sutherland, Charles J., Esq., Merchant, Calcutta ...	1838
	Sutherland, A. B., Esq., Merchant, Calcutta ...	1870
	Swaine, G. Esq., Ottur Factory, Tirhoot ...	1875
	Syed Wilayat Ali Khan, Patna ...	1876
610	Syed Fazhir Rohman, Mogulpara, Patna ...	1879

T.

	TAKILB SEDENATH SING, Zemindar of Kerabally ...	1874
	Takeda, Mr. George, Interior Dept., Japan ...	1878
	Tayloe, J. E., Esq., Merchant ...	1875
	Taylor, S. H. C., Esq., c. s., Beerbhoom ...	1878
615	Tennant, Col. J. F., Mint Master, Calcutta ...	1874
	Terveen,* W., Esq., Calcutta ...	1877
	Thomas, G., Esq., Zemindar, Monghyr ...	1875
	Thomas, J., Esq., Merchant, Calcutta ...	1867
	Thompson,* H., Esq. ...	1876
620	Thompson, H. E., Esq., Supdt. Govt. Telegraphs, Akyab ...	1879

I.—(Continued.)

Admitted.

	Thompson, Lt.-Col. W. B., Depy. Commr. Dumoh, c. p.	1879
	Thornhill, E. B., Esq., Civil Service, Banda	1875
	Thurburn, E. A., Esq., Calcutta	1879
	Toomey, Geo., Esq., Indigo Planter, Contai, Tirthoot	1870
625	Tottenham, the Hon'ble J. R., Civil Service, Calcutta	1873
	Tresham, W. C., Esq., Baylah Indigo Concern, Benares	1879
	Tucker, Robert, Esq., Tea Planter, Seesaugor	1867
	Turnbull, R., Esq., Calcutta	1878
	Turner,* H. B. H., Esq., Merchant	1868
630	Twynam, Lt.-Col., E. J. L., Executive Officer, Rangoon	1856

U

	Unwin, H., Esq., c. p., Midnapore	1879
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V.

	VENAYE Rao, Gunput Kibia Sahaib, Indore	1872
	Voss, C. W., Esq., Merchant, Parla-Kimidi, Ganjam	1874

W.

	WALKER, William, Esq., Tea Planter, Seesaugor, Upper Assam	1870
635	Wallace, Adolphus, Esq., Rungajaun Factory, Gola- ghaut, Assam	1866
	Wallace, G., Esq., Doria Factory, Golaghaut, Assam	1875
	Walton, T., Esq., N. B. State Railway, Nattore	1878
	Ward, W. E., Esq., Civil Service, Gowhattee, Assam	1873
	Ward, G. E., Esq., c. s., Jounpore	1878
640	Waterfield, Wilham, Esq., Civil Service, Calcutta	1870
	Watt, George, Dr., Educational Service, Bankipore	1875
	Way, Major G. A., Depy. Asst. Adj. Genl., Jubbul- pore	1879
	Webb, A. B. L., Esq., Manager, Lloyd's Bank, Dar- jeeling	1879
	Webster, Alex. L., Esq., Tea Planter, Nutwanpore, Sylhet	1867
645	Webster, R., Esq., Damer, vid Bagdogra	1879
	West, R. Barton, Esq., Calcutta	1876
	Westfield, W. F., Esq., Calcutta	1876
	White,* H. F., Esq., Ex-Engineer	1875
	Whitney, F., Esq., Merchant, Calcutta	1875
650	Whitty, Irwin, J., Esq., Civil Engineer, E. I. Rail- way, Chord Line, Giridhi	1867
	Wilcox, Frederick, Esq., Bengal Police, Midnapore	1876
	Wilkinson, C. J., Esq., Barrister-at-Law, Rangoon	1870

W.—(Continued.)

Admitted.

	Wilkinson, Capt. C. J., Supdt. P. & O. Company, Calcutta ...	1878
	Williamson, Capt. W. J., Inspector Genl. of Police, Assam, Shillong ...	1867
655	Williamson,* W. P., Esq., Supdt., Wilton Tea Co., Debrooghur, Assam ...	1877
	Wilson,* H. F., Esq., Serajgunge ...	1870
	Wilson, the Hon'ble Mr. Justice, High Court, Calcutta ...	1878
	Wilson, A., Esq., Merchant, Calcutta ...	1879
	Wood,* Dr. A., Goruckpore ...	1875
660	Wood, E. P., Esq., <i>Barrister-at-Law</i> , Calcutta ...	1879
	Woodman, J. V., Esq., <i>Barrister-at-Law</i> , Calcutta ...	1875
	Wood-Mason,* J., Esq., Asst. Curator, India Museum, Calcutta ...	1877
	Woosnam, J. B., Esq., Cinnamara, Jorehaut, Assam ...	1879
	Worgan, J. B., Esq., c. s., Sarun, Chupra ...	1878
665	Worsley, C. F., Esq., c. s., Mozufferpore, Tirhoot ...	1879
	Wyer, F., Esq., c. s., Burdwan ...	1878
	Wyatt, A. W. N., Esq., Bhukwa Factory, Durbhungah ...	1878
	Wright, W., Esq., Judge, Small Cause Court, Cuttack ...	1866

Y

	YULE, Geo. Udney, Esq., Merchant, Calcutta ...	1879
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Z.

670	ZANDER,* Leo, Esq., Merchant, Calcutta...	1872
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Monthly Proceedings of the Society.

Thursday, the 27th February, 1879.

THE HON'BLE LOUIS S. JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last Meeting were read and confirmed.

The Report from the Council was read and adopted.

The election of Officers and Council was next taken up with the following result :—

President.—The Hon'ble Louis S. Jackson, C. I. E.

Vice-Presidents.—Mr. W. H. Cogswell, Mr. W. Stalkartt, Rajah Suttayanund Ghosal, Bahadoor, and Baboo Kan Prosono Ghose.

Secretary.—Mr. A. H. Blechynden.

Council.—Baboo Peary Chand Mittra, Mr. E. Broughton, Mr. R. Blechynden, Mr. J. W. O'Keefe, Dr. S. Lynch, Mr. W. Waterfield, Baboo Protapchunder Ghosa, Mr. J. E. MacLachlan, Dr. Geo. King, Dr. J. B. Barry, Mr. S. H. Robinson, and Mr. H. J. Leitch.

Baboo Protapchunder Ghosa's name was added to the Tobacco Committee; the other Standing Committees need no strengthening, and remain, therefore, as in 1878.

The following gentlemen were elected Members :—

Messrs. T. T. Leonard and W. St. Clair Grant, the Managers of the Lalla-cherra Garden, Cachar, and of the Paikpara Estates.

The names of the following gentlemen were submitted as desirous of joining the Society :—

A. Wilson, Esq., Merchant, Calcutta,—proposed by Mr. W. H. Cogswell, seconded by the Secretary.

Syed Fzahir Rohman, Mogulpara, Patna,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Alister Mackintosh, Esq., Doorea Factory, Tirhoot,—proposed by Mr. H. E. Abbott, seconded by Mr. T. M. Francis.

Narsing Bow, Esq., Zemindar, Vizagapatam,—proposed by Mr. T. H. Mosley, seconded by the Secretary.

Leitchfield Moseley, Esq., Manager, Doorea Tea Company, Julpigoree,—proposed by Mr. J. Mackillican, seconded by Mr. S. Cresswell.

W. M. North, Esq., Proprietor, Bogracote Tea Estate, Silligoree,—proposed by Mr. Cresswell, seconded by the Secretary.

B. H. Carew, Esq., Assistant-Manager, Dim-Dim Garden, Julpigoree,—proposed by Mr. Creswell, seconded by the Secretary.

Prince Mahomed Furrock Shah, Russapugla,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

Manager, Haupjaun Hill Estates, Seebesangor, Assam,—proposed by the Hon'ble A. B. Inglis, seconded by the Secretary.

Baboo Narendra Narain Roy, Zemindar, Jemooah Kandhi, Moorshedabad,—proposed by Dr. G. King, seconded by Mr. J. E. MacLachlan.

Rejoined—Hon'ble H. T. Prinsep, Calcutta; Capt. J. F. Pogson, Simla; Howard Unwin, Esq., C. B., Midnapore; W. C. Tresham Esq., Cawnpore, and E. A. Thurburn, Esq., Calcutta.

HORTI-FLORICULTURAL EXHIBITION.

The following reports of the Judges on the show of vegetables, fruits and flowers, held in the Society's Garden on the 28th January, were submitted:—

" Horticultural.—(JUDGES: Messrs. W. H. Cogswell, S. H. Robinson, W. Stalkartt, Baboo P. C. Mittra, and Dr. Lynch.)

The Show may be considered as altogether a good one. About 25 kinds of European vegetables were submitted, and a good collection of Native vegetables. There was also a fair display of fruits. Among the European vegetables—beet, carrot, cauliflowers, cabbages, turnips, knolekole, and potatoes were well represented. Celery, artichokes, asparagus (both too early in the season) and peas were not so well shown. Of Native vegetables, the India corn was excellent for the time of year, and there was a great variety of chillies, beans, of many kinds, and ginger. In the Fruit Department—guavas, custard apples, (out of season) pine apples, and bael were well represented, the last named especially so, finer could scarcely be met with anywhere.

About 50 Market Gardeners were in attendance, with about 500 baskets in all; these occupied one-half the space under canvas, or rather more than 300 feet.

A list of the prizes in detail is hereto annexed, amounting to Rs. 227.

Floricultural—(JUDGES: Messrs. W. Waterfield, G. L. Kemp, John Scott, and H. B. Turner.)

The collection of plants brought forward on this occasion was on a larger scale than at last year's Show, and the competition was comparatively greater. There was a good display of handsome foliage plants, crotons, dracænas, begonias, palms, &c. Roses were well represented from several localities, including those from the Belvedere and Eden Gardens. Of verbenas, asters, phloxes, petunias, and portulacas, the collection was limited, being almost too early in season for them.

The Royal Botanic and Barrackpore gardens contributed some fine grown plants not for competition, but to add to the interest of the Show. From the former garden came a collection of 45 species of the Palm family, of which the

following may be noticed as new or rare in gardens, *viz.*, *Seaforthia elegans* and *robusta*; *Latania aurea*; *Hyophorbe Verschaffelti*, *Chamaedorea Erenbergseana*, *Calamus Andamanensis*, *tigrinus* and *longicetus*; *Kentea Wendliindiana*, *Ptychosperma rosea*, *Verschaffelti splendida*, *Bactris* sp., and *Aerocorma* species, both from Brazil. The Ferns and Lycopod families were represented by several species, amongst which were *Adiantum Farleyense*, *Polypodium conjugatum*, and the new and interesting *Nephrolepis Duffi* from the Duke of York Island. Of the Cacti tribe, there were a dozen different specimens, and 7 of the *Cycas* family and 9 orchids, including *Dendrobies* (2); *Phalaenopsis* (3); *Saccolabium giganteum*, and *Cypripedium concolor*. Of miscellaneous plants the following may be noticed as new or rare in Indian Gardens:—*Nepenthes Rafflesiana*, *Coleus pictus*, *Bowenia volubilis*, *Tacca integrifolia*, *Anthurium Beyrichianum*, *Agave filamentosa*; also *Eucharis Amazonica* in fine flower. •

The Barrackpore Park Garden contributed a nice collection of 87 plants, including palms, crotons, dracænas and ferns.

From the Belvedere Garden came a very large collection, for which many prizes were awarded. The cut specimens of roses were excellent, and there were many palms, crotons, dracænas, begonias, ferns, a few orchids, and many annuals.

The Eden Gardens also contributed largely and gained many prizes. They shewed palms, crotons, begonias, dracænas, ferns, oxalis, roses, cactus, and a collection of annuals.

The Rajah Suttyanund Ghosal Bahadoor submitted a large collection of foliage plants, geraniums, violets, and roses.

The Messrs. R. and H. Wood shewed foliage plants, ferns, and several well-grown geraniums.

From Shib Prosono Chatterjee's garden came a large collection of crotons including some new kinds, and a few dracænas.

The Camellias (6) from Mr. S. Apar's Garden were very well grown and in fine flower, white and red.

There were several competitors for the prizes placed at the Society's disposal by the Hon'ble Mr. Justice Jackson, the President. To Mr. John Lynam was awarded a prize for orchids (*Phalaenopsis Schillerianum*, *rosea* and *intermedia*; *Saccolabium giganteum*, and *Oncididium Lancianum*), and to Mr. D. Low for ferns of sorts, including *Adiantum farleyense* and *Gymnogramma peruvianum argyrophylla*. These ferns were well arranged in glass cases and were much admired. Mr. Low also contributed some well-grown palms, to which the first prize was awarded.

Specimens of the Assam Tea plant, of Liberian Coffee, and a few well-grown *Araucarias* and *Crotons* from the Society's Garden, were placed in the centre tent.

The attendance of visitors was considerable; probably one thousand in the garden during the time (3 to 6) the Show lasted.

The sum of Rs. 228 was awarded in prizes, of which a list in detail is annexed.
GARDEN.

The Head Gardener's report was submitted, of which the following are extracts :—

"The work since last report has been of a miscellaneous character, the general tidying up of the garden grounds occupying a considerable share of our attention. Propagation and potting of various plants still continue. In looking over the contributions made to the garden, I find that the violets sent to us by Mr. T. M. Francis of Tirhoot are looking very healthy. The seeds of *Blighia sapida* sent from Cawnpore farm were somewhat immature, and though they germinated, the seedlings were weak and died off in the course of a few days. I have noticed from the trees in our garden that the fruit nearly always falls to the ground before attaining the size it ought to attain, the fruit is exceedingly pretty, and should be used as a vegetable, whilst small and tender; its specific name is well deserved. The Australian seeds, presented by Captain C. J. Wilkinson, have, in some few cases germinated, though they have been sown since 28th August 1878. I noticed in the flower garden that Petunia, Lobelia, and Verbena seeds have germinated vigorously after having lain in the garden soil since last spring; I expect this is owing to their exclusion from the air: this throws some light on the preservation of seeds packed in the earth for import. The Rose Garden has been smartened up, but many plants having died a long time ago, causes it to shew too much soil in *proportion to flowers*. It would be an improvement to reintroduce the same, direct from England. If we re-import these roses, we might get *some new kinds also*,—a few Caladiums, Crotons, dwarf habit Palms, &c., and also Liberian coffee seedlings, in large quantity. A portion of the garden might be set apart for their cultivation, as this coffee is eagerly looked for by Members and others interested in its introduction on a large scale into India. We should, I think, take as much interest in its introduction as private parties, who, though willing to order for themselves, have not the same facilities of communication as we must of necessity have from our long experience. We have only a few plants in the garden, and what few seeds they give produce plants after an extremely long interval—the supply being quite inadequate to the demand. Plant houses are being cleaned and regulated, and general preparations are being made for the protection of plants during the coming glare of the hot weather."

TOBACCO.

Read a report from Messrs. Anderson Wright & Co., on some tobacco submitted by Mr. O'Connor of the Department of Revenue, Agriculture and Commerce. The plant was grown at Myouk-Toung in Arracan hill tracts and cured at the Government tobacco farm at that place by Mr. Schoenemann, the Superintendent. The tobacco is considered a good article, not unlike what is known in Calcutta

as Hinghlee, and which is much appreciated by the Ooria buyers. For export in the present state of prices in Europe it would be but of little value.

COTTON.

Read the following report from Mr. W. H. Cogswell on certain specimens of cotton, (New Orleans, Upland, Egyptian, Bamia, Nankin, Hingunghat) raised in the Saharunpore Botanic Garden, and forwarded by Mr. Duthie, the Superintendent :—" I have very carefully examined the samples of cotton grown at Saharunpore Botanical Garden which I consider most creditable. I should have been better able to give more of a detailed report had some of the cotton been removed from the bolls, ginned in the usual way and the seed removed. I place opposite the names of the samples the classifications as I think the trade would accept them in England, on the assumption that they had been grown in the countries from which the seeds have been imported, and not in the garden above named, as I am of opinion that the quality is very little, if any, inferior to those descriptions grown on their own soils."

Read another report from Mr. Cogswell, on some cotton raised in the Meerut District, by Emtar Ali Khan, a zemindar, from seed brought from Mecca, and of which a small sample was previously received, too small to report on. "This sample as now seen in quantity," observes Mr. Cogswell, "is not at all like the small sample sent to you in a letter. It is very red, most irregular in staple, the bulk of it being almost worthless, here and there portions of staple equal in length and character to Rangoon; any thing but a desirable article of commerce and probably not worth more than Rs. 8 to Rs. 9 a maund as against Rangoon at Rs. 14 to 15. From its very mixed quality and condition I think it has been badly prepared, and that more might be made out of the seed under a careful cultivation, picking and ginning."

CROCODILE OIL.

Read the following report from Dr. Kanny Lal Dey, on a sample of Crocodile oil received from Mr. Purcell of Agra. Mr. Purcell intimates that if of any commercial value he could obtain a large quantity of this oil :

"I submitted to comparative examination the Crocodile oil with other animal oils, with the following result :—

"Crocodile oil contains a larger proportion of solid fat than either the Neats-foot or Codliver or other fish oils. It solidifies at the melting point of ice, while Neats-foot only slightly thickens, and the others scarcely thicken. I have also tried the softening quality of the various animal oils on leather, and on comparison I find the leather treated with Crocodile oil remains much stiffer than others treated with other animal oils.

"From the above results I do not consider that Crocodile oil has as much commercial value as Neats-foot oil."

LAC ON TEA BUSHES.

Messrs. A. R. Mackintosh & Co., send some cuttings from tea bushes at Lizzie-pore Garden, Kurseong. The Manager thought the bushes were being covered with lac, but this seeming doubtful, they ask for a report thereon. The Secretary stated that he had referred these infected twigs to Mr. Cogswell who had obligingly reported on them:—

"I have examined the small twigs of the tea bush which bear a deposit and for which you seek a name. It is most difficult to do so. It is an unmistakable resin, and I am half inclined to think that it is the deposit of the lac insect, 'kermes lacca,' or 'Coccus laccus.' It contains dye or slight coloring matter to a very small extent only, as the enclosed test I have made will show. That, however, may be attributable to the fact that the insect had only just deposited the eggs which had not time to mature when the branches were cut.

"I may mention that these remarks refer to the twigs that you first sent to me from a portion of which deposit I made the experiment, not to the accompanying ones. A close inspection of the two will show you that the difference is in the latter sample having the deposits of a greyish white color and much less matured than the former.

"I am sorry that the deposit is not more matured, that fact renders this opinion somewhat uncertain."

NEW MODE OF MULTIPLYING PLANT.

Read a letter from Mr. T. M. Francis, in continuation of his previous communication submitted at the General Meeting in November last. (*See body of Journal.*)

Letters were read:—

"From F. Moore, Esq., India Museum, London, respecting some diseased tea leaves (red spider) from the Tukvar Tea Co.'s Gardens, Darjeeling—(*See proceedings for September last.*) 'These tea leaves,' remarks Mr. Moore are 'infested with a species of coccus, which is, apparently, quite new, both as to its attacking tea and in regard to its species, so far as I have been able at present to determine. In the small perforated tin box which was also duly received, and in which you mention was 'an insect from the Cossypore Tea Garden in Cachar, which was found by Mr. Edgar on a partially eaten tea leaf,' I could find no vestige of an insect. This doubtless escaped through the perforations during transit. I much want to get good specimens of the *Psyche* or case-bearing insects which is stated to attack tea plants. Will you kindly send me specimens, if possible, of both the cases and the moths; the latter particularly."

From Colonel W. H. Lowther, Benares,—presenting a paper on Capsicum and Chillies. (*Transferred for Journal.*)

From E. Buck, Esq., Director, Department of Agriculture, North-West Provinces, forwarding reports of trials of the Prickly Comfrey at Saharanpore and Kumaon. (Transferred for Journal.)

Mr. Lynam sent for inspection a well grown plant, in flower, of *Onoidium (sphacelatum majus?)*

Mr. Manukjee Rustomjee, also sent for inspection, an unusually large specimen of a native pumpkin, or bottle gourd—native name *Lao* (*Cucurbita Lagenaria*.) This pumpkin measures 4 feet 9 inches in length.

Baboo Protapachundra Ghosa placed on the table specimens of tobacco sun-cured, fire-cured, and air-cured, and cigars made therefrom which he considered the best he had seen. This tobacco was raised and prepared at Messrs. Begg, Dunlop & Co.'s plantation at Poosa.

Thursday, the 27th March, 1879.

THE HON'BLE LOUIS S. JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—Messrs. A. Wilson, Alister Mackintosh, Narsing Row, Leitchfield Moseley, W. M. North, B. H. Carew, Syed Fazhir Rohman, Prince Mahomed Furrock Shah, Manager, Haupjaun Hill Estates, Sebsaugor, Assam, and Baboo Narendra Narain Roy.

The names of the following gentlemen were submitted as desirous of joining the Society.

Baboo Shiv Partap Narain, Pleader, Chupra,—proposed by Mr. J. B. Worgan, seconded by the Secretary.

Louis de Saint-Hilaire, Esq., Merchant, Chittagong,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Manager Arcuttipore Tea Co., Cachar,—proposed by Mr. J. W. O'Keefe, seconded by Mr. J. Mackillican.

Manager Hathighor Tea Estate, Mungledye, Assam,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

CONTRIBUTIONS.

1. The Indian Forester, No 3, Vol. IV. From the Editor.
2. Review of the Forest Administration for 1876-77. From Government of India.
3. Report on the Internal Trade of Bengal, 1877-78. From Government of Bengal.
4. Report on the Administration of Bengal for 1878. From Government of Bengal.
5. Madras Journal of Literature and Science for 1878. From the Editor.
6. Records of the Geological Survey of India, Vol. XI, Part 4. From the Government of Bengal.

7. *Memoirs of the Geological Survey of India*, Vol. XIV, and *Palaeontologia Indica*, Ser. XII, and Ser. IV., Vol. 1, Part 3. From the Superintendent.

8. Report of the Bengal Chamber of Commerce, May to October 1878. From the Chamber.

9. Journal of the Asiatic Society of Bengal, Part 1, No 4 of 1878, and Proceedings for November and December 1878 and January 1879. From the Society.

10. Plants of *Eucharis Amazonica* and Violets. From T. M. Francis, Esq.

11. Lavender seedlings, &c. From W. G. Amos, Esq.

12. Seed of *Cedrus Deodara*. From Dr. G. King.

13. Guinea grass seed. From W. B. Carshore Esq.

14. A collection of acclimatised flower seeds, balsam, zinnia, &c. From H. E. Abbott, Esq.

15. Several kinds of American tobacco seeds. From the Director Department of Agriculture, N.-W. P.

16. A collection of seeds of forest trees from the Andamans. From E. H. Man, Esq.

GARDEN.

The Head Gardener's report was read as follows :—

"I am afraid there is little of interest to report this month. Labour in the various departments goes on steadily, water unfortunately taking up too much of our employé's time. If we could by any means secure a connection with the canal outside, we might have a channel running through the Garden, with branches from it, to different parts of the Garden grounds, and then give our plants [which are chiefly cultivated artificially in pots] the benefit of a copious supply of water. We have secured the services of several malees, who will prove useful no doubt; our every endeavour must be concentrated in securing a sufficient staff of malees to commence decided and active operations early these rains. Concerning Liberian Coffee I must say that the experiments which have been carried out have been exceedingly barren of results, for out of many batches of cuttings put down only 3 cuttings formed roots, and those were prepared with the knife in a different manner to the others, which I have tried to make plainer by the diagram sent herewith. I shall repeat this experiment. I have sent one ripe fruit of *Coffea Liberica*. This is just about the stage of ripeness which warrants their being plucked, they never colour highly, the fruit however will speak for itself. It is now beginning to wither up near the apex. I have also sent several others, these have grown to a certain size, and have then died. I also think the American method of striking cuttings, as mentioned by Mr. Francis of Tirhoot in last month's proceedings, is worth trying on this coffee.

Proceedings of the Society.

"Seeds have been received as follows and have been duly sown:—

"I. Palm seeds from Botanical Garden, Mauritius.

"II. Moonflower, Loquat, Sapota, Violet from Society.

"III. Collection of seeds from Andamans, from Mr. E. H. Man.

"A few leaves of *Oleus pictus* are herewith sent, as perhaps some of the Members may not have seen it thus variegated, it promises to be a very pretty and also an easily cultivated plant. As the specimen from which these leaves were taken was grown in the shade, the colours are not so brilliant as they would be, provided they received more light, which they certainly would receive if cultivated as out-door plants during the cold season."

A report from the Garden Committee was also read. The Committee express their satisfaction at the state of the Garden and Mr. Gleeson's exertions. They recommend an order on England for a collection of ornamental plants of sorts, principally of roses, and the erection of another large house for the reception of stock plants. Agreed to.

TEA MANURE.

Messrs. Ede and Hobson, agents for Messrs. Ohlendorff's specially prepared tea fertilizer, present one hundred weight of the manure for trial. *Resolved*, that it be distributed as judiciously as possible for trial in Tea Gardens, and that it be also tried in the Society's Garden.

LAND MEASURES OF ISRAEL AND ENGLAND.

Submitted the following extract of a letter from Captain J. F. Pogson:—

"Ancient the 'Land Measures of Israel and England,' it is very remarkable that the rainfall, as now scientifically measured, exactly corresponds to these Land Measures, with their very remote antiquity. For example, the fall of rain on any given date, or any shower, on being measured, supplies a data, which multiplied by a key number, shows at once how many cubic feet of water has fallen, and conversely artificial irrigation may be ruled and controlled accordingly. Thus when we are told that inches 1.2 of rain has fallen, the mind does not realize the information. But when it is explained that inches $1\frac{2}{5}$ of rain means that one hundred ounces of water has fallen on every square foot of surface, we learn that 2 quarts, (or 80 oz.) and one pint, (or 20 oz.) of water, has passed from the clouds to the earth; and so on in proportion for every $1\frac{2}{5}$ inches. Now if we want to make a reservoir, which, when filled, will always contain sufficient water to yield a supply for one acre and equivalent to a rainfall of $1\frac{2}{5}$ in., what must be the dimensions of the square reservoir or circular well holding the quantity needed?"

Answer—Square reservoir will be $16\frac{1}{2}$ feet square, and 16 feet deep, and will hold cubic feet 4,856 of water; or the exact equivalent of a rainfall of inches 1.2.

"Proof—The Acre equals square yards 4,840, which multiplied by 9, gives square feet 43,560 in the acre. Now 100 oz. equal to 1 square feet. These $43,560 \times 100 =$ ounce 4,35,000 which divided by 1,000 (the number of ounces in a cubic foot) gives a quotient cubic feet 4,356. Hence it follows, that a rain fall of 1·2 inches and the application of the contents of the reservoir (4,356), are equal to each other.

"The late Mr. Login, Supdg. Engineer, Ganges Canal, told me that the zemindars insisted on having a certain depth of water, which he roughly indicated on the table. I measured it off to scale and found it over inches $7\frac{3}{4}$, that is more than six falls of rain, each measuring inches 1·2. Mr. Login said they (zemindars) would have this quantity at each act of irrigation.

"Can we be surprized at the result. Imagine the state of the surface soil and sub-soil, after the application of cubic feet 26,186 of water to one acre."

APPLICATIONS FOR SEEDS.

Letters were read—

From Baron F. von Mueller, applying for seed of *Reana luxurians*. As yet in two places only of Queensland have the seeds ripened, though given to many parties. The demand for the seed is very great in such an extensive country as Australia. "I will send you," adds the Baron, "more seeds of *Festuca dives*, as soon as they are ripe again; also I will try to obtain for you the seeds of *Araucaria Cookii*, but in the present state of trouble in New Caledonia, it may not be possible to get them readily. I am glad that the Indian Government, through the action of Sir Andrew Clarke, intends to republish my "select plants." A copy with extensive additional notes will go to Calcutta by this post. The work ought to be of very great use to the whole of Upper India, and ought to serve also particularly the Indian Forest Department."

From C. E. Fendall, Esq., Forest Department, Phillour, applying for seed of *Reana luxurians* for introduction into the Bussahir Sutlej Valley.

From Col. W. H. Lowther, alluding to the heavy yield of seed of *Reana*. "Fancy *Reana* seeding so heavily in the Nepal Terai that two ounces gave 14 pounds. Besides this there were two or three cuttings of forage. But then the irrigation resources of my friend Mr Peppè's lands are unlimited, he has miles of water cuts."

From the Deputy Commissioner, Damoh, applying for a quantity of Jute seed for distribution in his district, and information as to the mode of culture and preparation. Complied with.

From J. Cameron, Esq, Agra, on the subject of *Rhea* specimens for report, and, if not approved of, test specimen to assist him in the preparation of a machine for competition for Government prize. Complied with fully.

HORTICULTURE AT KOTEGHUR.

Read the following extract of letter from Captain Pogson :—

"Some years ago, you sent me a few seeds of 'New Zealand Bean,' and of my first crop I gave some to Rev. Mr. Rebsch. This Bean has now become completely acclimatised here, and its seeds are called 'Sparrows Eggs' by the Paharrees.

"In 1871, whilst at Kussowlee, you sent me two or three seeds of a magnificent Pumpkin, or Gourd from California, and I grew two plants, but the fruit was cut before it could ripen seed. If possible, in due time, I should very much wish to obtain a dozen or more of these seeds, and I will take care to keep all produce, but two, for seed, and let the Society have half of it for distribution to Members.

"I am now located in a place, having a good soil, lots of water, and a shell lime deposit, a few miles ($3\frac{1}{2}$ to 4) distant, consequently I can grow any thing, good land being available I hope D. V. to pass 5 years out here, and I shall at all times be happy to grow anything, suited to the climate, which you may wish to have raised under an India bill suu, previous to introduction into the plains of India.

"I am told that a very good description of wild pea grows all about this locality, and also a large wild strawberry, the fruit being of the best description. Of course I shall put both under high cultivation and report results sending you samples. The pea is collected and eaten boiled, and stewed, just like the cultivated pea. 'It will be curious if this wild pea turns out to be the father of the cultivated kind. These remarks are equally applicable to the strawberry, with its high fragrance and large sweet fruit.'"

WILD SILK YIELDERS, &c.

Letters were also submitted—

From P. H. Grosse, Esq., Torquay, applying for living cocoons of various kinds of Indian Silk yielders.

From the Director Department of Agriculture, N.-W. P., sending some moths with request for identification.

The Secretary stated that as yet he had been unable to meet these requisitions.

From S. E. Peal, Esq., Assam, in respect to the "Psyche" applied for by M. E. Moore of the India Museum as stated at last meeting.

Letters were read from Mr. W. Helps of Punkabarree, reporting most favorably on Buist's American Vegetable seeds,* and from Baboo P. C. Banerjee, Superintendent of the Eden Gardens, to the same effect, regarding the French and German flower seeds received from the Society.

Thursday, the 22nd May, 1879.

THE HON'BLE LOUIS S. JACKSON, C. I. E., *President, in the Chair.*
The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected members :—

Mr. Louis de Saint-Hilaire, Baboo Shiv Partap Narain, and Managers of the Arcuttipore Tea Company, Cachar, and of the Hathighor Tea Estate, Mungledye, Assam.

The names of the following gentlemen were submitted as desirous of joining the Society :—

Captain A. Evans Gordon, Deputy Commissioner, Chittagong Hill Tracts,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

A. B. L. Webb, Esq., Manager Lloyds' Bank, Darjeeling,—proposed by Mr. W. H. Cogswell, seconded by Mr. W. Stalkartt.

Superintendent Government Horticultural Garden, Lucknow,—proposed by the Secretary, seconded by Mr. Leitch.

Manager of the Awa Estate, Agra District,—proposed by Mr. E. Buck, seconded by the Secretary.

H. Meyer, Esq., Cootahi Factory, *vid* Baraitch, Goruckpore,—proposed by Mr. W. B. Carshore, seconded by the Secretary.

Lieut.-Col. W. B. Thomson, Deputy Commissioner of Dumoh, C. P.,—proposed by the President, seconded by Mr. S. H. Robinson.

Dr. A. E. Dalgairns, 7th Regiment, M. N. I., Berhampore,—proposed by Mr. W. F. Grahame, seconded by the Secretary.

Rejoined.—J. Buckingham, Esq., Manager, Amjooree Tea Estate, Assam.

CONTRIBUTIONS.

1. A Manual of the Geology of India, Vols. 1 and 2 and Map. From Government of India.

2. Progress Report of Forest Administration in Bengal, 1877-78. From Government of Bengal.

3. Journal Bombay Branch of the Royal Asiatic Society, No. 86, Vol. XIV. From the Society.

4. Transactions of the Asiatic Society of Japan, Vol. VI., Part 3, and Vol. VII., Part 2. From the Society.

5. Journal Asiatic Society of Bengal, Part 2, No. 4 of 1878, and Proceedings for February and March 1879. From the Society.

6. Economic Products of the North-Western Provinces. Part 3, Dyes and Tans. From Director Department of Agriculture, North-Western Provinces.

7. The Indian Forester, No. 4 of Vol. IV. From the Editor.

8. Records Geological Survey of India, Vol. XII., Part 1. From Government of Bengal.

9. Journal Royal Horticultural Society of London, Vol. V., Parts 6 and 7. From the Society.

10. Proceedings of the Imperial Botanic Society of St. Petersburg, Part 2, Vol. V. From the Society.

11. Some Nuts of the "Coco-de-Mer" (*Lodoicea Sechellarum*) and seeds of other Palms. From Director of the Royal Botanic Garden, Mauritius.

12. A few seeds of *Amherstia nobilis*. From Major Fanshawe.

13. A collection of plants and seeds from the Andamans. From E. H. Man, Esq.

14. Seed of *Pithecolobium saman* and Teak. From the Superintendent Royal Botanic Garden, Calcutta.

15. Some acclimatized American maize seed, nearly equal to imported stock. From Dr. F. Lynch.

16. A few tubers of *Gesnera*, *Achimenes* and *Tydas*. From Dr. T. Beaumont.

17. Seed of *Eucalyptus Barleyana*, and of a thorny melon bush, (*Acanthosicyos horrida*). From Baron E. von Mueller.

18. Some seed of the "Forbidden fruit," of Shaddock and Orange. From Col. W. M. Lees. (Germinated freely.)

19. Some cakes of "Umwut" or "Amsutu." From Baboo Srimohun Thakoor of Berari, Bhaugulpore.

The Baboo gives a note of the mode of preparing these mango cakes which he describes as superior to what are generally prepared. He uses the finest Bombay mangoes for the purpose unadulterated with any other ingredient.

GARDEN.

The Head Gardener's monthly report was read, of which the following is an extract:—

"The late unusual dry weather which may continue for some time yet, has severely tried the plants in the Garden; many palms have either died, or are about dying for want of water, and the general collection of plants have suffered proportionally. We have a project just now in hand for deepening our tanks, which, in connection with channels from different parts of the Garden grounds, will ensure a more copious supply of water to be stored up for future use: in fact, we can hardly have too many tanks in a garden. Labour has chiefly been watering, digging channels, potting off young stock, seed sowing, and other minor works. The new Plant-House is progressing, and will, I think, be of considerable service when finished; we must however have a shower or two of rain on the flooring to settle it firm, before roofing it. We have been supplied from the Commissariat Cattle shed, with a large quantity of useful manure which will prove valuable for application to our new Orchard, as the trees will be benefited thereby. I herewith add a list of seeds contributed since last report; also noting which have germinated, all the following seeds were sown in the ordinary manner except the double cocoanut for which pits 3 or 4 feet in depth were dug, the soil again replaced to within a foot of the original surface, the nut laid in position on its side, placing the widest sinus downwards to allow for the passage of the rudimentary parts of the young plant (which when

they germinate, will meet with no obstruction in downward course) which I understand grows to the length of 3 or 4 feet before emitting the primary leaf. [See page 240, Williams' Ornamental leaved plants, Vol. 2, Ed. 1876.]

"We have also secured about 19 Liberian Coffee berries yesterday, which were duly sown.

"Mr. Gleeson adds that some of the seeds referred to under the contribution head have germinated; others have not been sown sufficiently long to report on; the seeds of *Amblerstia nobilis* from Major Fanshawe have unfortunately failed.

APPLICATIONS FOR SEEDS.

Letters were read—

From Capt. Evans Gordon, Deputy Commissioner, Chittagong Hill Tracts, applying for Carolina paddy and Tobacco seed. (Complied with). Capt Gordon mentions that he has this year planted out "about four acres of seedlings of Havanna, Manilla, Shiraz, Saudoway, and Delhi, and the plants which have grown most luxuriantly are now under process of curing. I am anxious to obtain some Carolina paddy, if you will assist me in this I shall feel much obliged, as I should like to give it a trial here this rains. I hope to submit samples of the tobacco grown here, as also of the other plants and trees, &c., with which we are making experiments."

From the Superintendent Revenue Survey, Bhaownagur, applying for Bamia Cotton seed for trial in that part of Khateawar and instructions for raising it, and promising to communicate the result. (Complied with)

From Major Jacob, Executive Engineer, Jeypore State, applying for seed of *Pithecolobium saman*. (Complied with). "I have been much interested," observes Major Jacob, "in the paper on *Pithecolobium saman*, page XXXIV., Vol. VI. of the Society's Journal. It appears to me that this would be just the sort of tree for Rajpootana, and I am very anxious to give it an extensive trial. I write to ask if you can favour me with a large supply of seed, or inform me how it can be got. I shall be happy to take as much seed as I can get on payment if necessary. Also, I shall be glad, if you would kindly favour me with simple directions as to the best way to treat them; time and manner of sowing, and management, afterwards. If you can help me in any way, I shall be greatly obliged."

From J. H. Bridgman, Esq., Goruckpore, on the subject of seeds of sundry useful plants. The following is an extract of Mr. Bridgman's letter:—

"I have to thank you for a packet of the *Pithecolobium saman* seed, which reached me ten days ago, and for which I am much obliged: It was followed by the number of the Agri.-Horticultural Society's Journal referred to in your note, where I found, in the page indicated by you, an account of this very valuable tree. If it will vegetate and thrive in this part of the world a great benefit will have been gained.

"Mr. Buckland, the gentleman in charge of my indigo factory of Bella Hariya, Lehra, has grown successfully the *Reana luxurians*, and has an abundance of seed. I need not therefore trouble you for any. The *Reana* is an annual, and requires cultivation and irrigation for its growth. What we still want is a deep-rooted perennial grass that will grow spontaneously, and of which the leaves will afford good pasture for cattle. I say 'deep-rooted' because it is only a deep-rooted grass that, finding moisture for its sustenance the subsoil, will give leaf in the hot season. Those deep-rooted wild grasses of this country with which I am acquainted all yield a leaf too coarse and harsh for cattle to feed upon; and if a grass, such as I have described which they would eat, could be found, the discovery would be invaluable. In a letter from the correspondent of the *Pioneer* with the Thull-chotiali force, published a few days ago, the writer spoke of the excellence of the beef and mutton, and the thriving condition of the cattle of that country which he attributed to the good quality of the pasture grass prevailing there. That must be a very dry country, and it seems probable that a grass growing well there would also thrive in these provinces. I suggest that some of the seed should be procured, if practicable, for the purpose of experiment in the Benares Province.

"Since I last wrote to you I have lighted upon an extract I made from the *Pioneer* of the 9th of October last, descriptive of another valuable tree, of which the cultivation is suggested. It is called *Catalpa bignonioides*, and is described as 'possessing a lovely flower,' and as being 'most valuable for the lasting qualities of its wood. It is easily propagated, grows rapidly in almost any soil, and so far as is known, is free from the attacks of insects. The wood also, besides durability, possesses beauty to a considerable extent, its general colour being a warm buff, taking a fine polish, and being well adapted for cabinet work.' If you have any seeds of this tree I shall feel greatly obliged if you can spare me a few."

The Secretary mentioned he had applied to the Society's Seedsmen at Philadelphia for seed of this *Catalpa*.

From E. Buck, Esq., Director, Department of Agriculture, N.-W. P., applying for certain varieties of spring wheat. (Application put in hand.)

From Baron Ferd. von Mueller on the subject of *Reana* (*Euchlana luxurians*). "Let me thank you for your kindness," writes the Baron, "in forwarding so liberal a supply of seeds of the *Euchlana luxurians*. This enables me to push this plant further through Australia than I could do 2 or 3 years ago. I have sent for seeds of *Festuca dives* to the fern tree gullies of our mountains, the nearest place to get them being 40 miles distant; I hope to have them for the next mail. The seeds of *Araucarias* I have ordered from Queensland, Australia being a continent almost as large as Europe, I need hardly say that for some years we can never get too much seed of such a superb grass as the Teosinté [*Reana*] for distribution."

The Secretary stated he had despatched a further and larger supply of the Reana seed.

COMMUNICATIONS ON VARIOUS SUBJECTS.

Communications were submitted—

1. From Assistant Secretary Government of Bengal, P. W. D., Irrigation Branch, applying for information in respect to the proposed cultivation of cocoanuts on the Midnapore and Orissa canal banks, as the Lieutenant-Governor is willing to sanction an annual sum for such purpose. Information given.

2. From Captain J. F. Pogson on the subject of a Medicinal Garden at Koteghur. The following is an extract of Captain Pogson's letter:—

"I am much in want of some *Digitalis purpurea* seed, and if you could send me some I should esteem it a favor and be greatly obliged. I have the Yellow Fox Glove, but want the other, as it is the right kind for medicinal purposes.

"I think all, or nearly all, the medicinal plants of the Pharmacopœia may be made to grow to perfection in these parts, and I have therefore decided on starting a medicinal plant garden. I am gradually getting in seeds and roots, but I do not know where to obtain certain seeds from. Of these *Momordica elaterium*, called 'Spirting Cucumber' and 'wild Cucumber,' is one. It is stated to be peculiar to the south of Europe, and that is all my present information. On looking at a chemists list, I find its preparation 'Elaterium,' priced wholesale at Rupees Eighteen per ounce. Extract Chiretta is down at Rs. 20 per lb., and 'Aconitia Ang' is Rs. 15 for a dram. 'Atropia' is priced the same. Extract Belladonna is Rs. 6, and numerous other things which could be grown here in proportion.

"If the Society would help me in carrying out this project, the public would in a few years be greatly benefited. I do not want money, but aid in obtaining seed and live roots, and this might be accomplished through the agency of the various Horticultural Societies with which our Society corresponds."

Resolved—That Captain Pogson's requisition be placed on the Proceedings with the view of eliciting information and help.

Captain Pogson adds—

"I may now mention that last year I wrote to Mr. J. F. Duthie on the subject of grafting the '*Ficus elastica*,' on the '*Ficus Indica*,' in order to make the latter act as milch cow, to the former. Last month I heard from Mr. Duthie, who in answer to my questions, said the experiment as far as the grafting went was a success. But time was needed for its completion, which I presume means tapping the '*F. elastica*' for its milk. This experiment might now be repeated in the Society's and other gardens in and about Calcutta, and the hitherto useless Banyan tree might be turned to very profitable account."

3. From the Superintendent Horticultural Garden, Lucknow, sending for analysis some bark of *Eucalyptus citriodora*. "The leaves of the species,"

observes Mr. Ridley, "are very sweet scented, and I found the bark was also slightly scented. It peels off in large pieces and leaves the stems clean and white. I thought it might possibly be of some use medicinally or otherwise, and if you think so you could perhaps get it analyzed and ascertain whether it is of any value or not. The trees grows very rapidly here, and in time the bark could be produced in quantity."

The Secretary mentioned he had transferred this bark to the Secretary Economic Museum, and it had been tested by Dr. Kannayall Dey, with the following results:

"I have submitted the bark of *Eucalyptus citriodora* you handed to me to both physiological and chemical tests with the following results:

"A strong decoction prepared from the bark was administered to a cat, and the animal showed no symptoms of uneasiness whatsoever: hence I conclude here is no toxic property in the bark.

"I tried to find if there was any astringent property in the bark, but I found it contained more tannin than many barks of a similar nature; but in comparison with Babul bark (*Acacia Arabica*) I find it contains less. On incineration it yields alkaline salts."

4. From the Secretary, Government of Punjab, submitting copies of reports of Canal Officers on the experimental cultivation of *Reana luxurians* on Canal banks in the Punjab in the year 1878, from seed supplied by the Society. (Transferred for publication in the Journal.)

5. From P. Mischea, Esq., Ghazee-pore. Some useful notes on the production of sugar in the Benares district. (Transferred for Journal.)

Friday, the 27th of June, 1879.

RAJAH SUTTYANUND GHOSAL BAHADOOR, V. P., in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected members:—

Captain A. Evans Gordon, Superintendent, Government Horticultural Garden, Lucknow, Manager of the Awa Estate, Agra district, Messrs. A. B. L. Webb and H. Myer, Lieut.-Col. W. B. Thomson and Dr. A. E. Dalgairns.

The names of the following gentlemen were submitted for membership:—

H. P. Rushton, Esq., Calcutta,—proposed by Mr. H. J. Leitch, seconded by Mr R. Blechynden.

G. R. Aberigh-Mackay, Esq., Principal, Residency College, Indore,—proposed by the Secretary, seconded by Mr. W. Waterfield."

Mr. Sorabji Dadabhoi, Patell, Mhow,—proposed by the Secretary, seconded by Dr. S. Lynch.

Alfred C. Brett, Esq., c. s., Jessore,—proposed by the President, seconded by Mr. S. H. Robinson.

J. B. Woosman, Esq., Cinnumara Tea Garden, Jorehaut,—proposed by Mr. St. Geo. A. Showers, seconded by the Secretary.

J. C. Grieff, Esq., Ranikhatt,—proposed by the Secretary, seconded by Mr. J. Caldwell.

Rejoined—Lieut.-Col. A. E. Campbell, Deputy Commissioner, Sibsangor, Assam, and W. G. Conroy, Esq., Calcutta.

The following gentlemen were proposed, on the recommendation of the Council, as Honorary Members :—

Lieut.-General Sir A. P. Phayre, G. O. M. G. ; K. C. S. I. ; C. B. ; and Baron Ferdinand von Mueller, C. M. G. ; M. D. ; Ph. D., F. R. S., Government Botanist for Victoria.

CONTRIBUTIONS.

1. Progress Report of Forest Administration in Assam for 1877-78. From Government of Bengal.

2. Proceedings Agricultural and Horticultural Society, Madras, December 1878 to April 1879. From the Society.

3. Suggestions on the maintenance, &c., of forests ; by Baron Ferd. von Mueller. Presented by the Author.

4. Journal Asiatic Society of Bengal, Part 2, No. 1, 1879, and Proceedings for April. From the Society.

5. Half-yearly Report of the Committee Bengal Chamber of Commerce, April 1879. From the Chamber.

6. Seed and seedlings of *Säl*, of *Casuarina* and *Ravenala*. From Superintendent Royal Botanic Garden, Calcutta.

7. A further supply of seeds of timber, and other trees from the Andamans. From Mr. E. H. Man.

8. Seed of acclimatized *Balsam* and *Reana luxurians*. From Mr. W. G. Amos.

COMMUNICATIONS ON VARIOUS SUBJECTS.

The following papers and letters were submitted :—

1. From O. H. Brookes, Esq., Notes on Tea Planting in the Andamans, accompanied by specimens of tea manufactured therefrom ; with report thereon by Messrs. W. Moran & Co.

2. From the Secretary, further Notes on *Bamia* Cotton, with specimen from his Garden ; and report thereon by Messrs. W. Haworth & Co.

3. From J. E. O'Connor, Esq., a Note regarding *Manilla* Hemp with specimens raised on the Andamans and at Vytteri ; and report thereon by Mr. John Stalkartt.

4. From J. E. O'Connor, Esq., a paper on the cultivation of the Ground Nut in India.

The above four papers were transferred for publication in the Journal.

5. From G. F. Pinney, Esq., submitting for report and valuation a

specimen of an indigenous Tea. Messrs. Moran report, "that this tea appears to have been made from a peculiar variety of the tea plant, but from any samples we have seen at present, we should think that it would not find favor in the London market. The liquor is not only very pale in colour, but is without the flavour and rich strength of the usual article of commerce. As regards the appearance of the leaf, the tip is entirely different from anything yet produced, and speaking of this tea generally we have no means of saying how it is likely to be received by consumers."

The Secretary remarked that he had requested Mr. Pinney to send leaves of the plant from which this specimen has been manufactured with the view of identifying it.

6. From G. F. Pinney Esq., specimen of a blight which is new to him. (Referred to Mr. Moore of the India Museum.)

7. From G. F. Mewburn, Esq., details of the result of manure on a Tea Garden. (Transferred for Journal with other papers on same subject.)

8. From Captain J. F. Pogson, regarding a pumpkin of enormous growth and weight—"The information alluded to in my previous letter," observes Captain Pogson, "is now given more in detail. I think the Society might take up the subject with great advantage to the people of India. A squash of 200 lbs. would be food for 200 men for one day, and it would also answer for cattle food, the seeds are white and large, very like the Californian pumpkin seed you sent me in 1871 at Kussowlee, only they are larger. I hope my trial will be a success, and if so, the very largest pumpkin will be reserved for you."

The following is extract of the Rev. Mr. Carleton's letter to the Rev. W. Rebsch, Kotegurh:—

"I send squash seeds. They come from Chili, South America, and on the Pacific Coast; they are of 250 pounds weight. In a dry climate they grow to enormous size, under scientific cultivation, one thousand pounds. I hope to produce one in four months of at least 200 lbs. Tell Captain Pogson to sow it in light rich loam 2 to 3 feet deep, the root will go down 3 feet deep and as big as a man's arm."

9. From E. Buck, Esq., Director, Department of Agriculture, &c., N.-W. Provinces, applying for certain kinds of American Maize suitable for cooler latitudes.

10. From J. E. O'Connor, Esq., Government of India, Department of Agriculture, applying for Egyptian Cotton and acclimatised Russian Flax seed for trial in the Arracan Hill Tracts.

The Secretary stated that steps had been taken to meet the above applications.

11. From Secretary Agricultural and Horticultural Society, Madras, and

Superintendent Botanic Garden, Hongkong, returning thanks for Journals and Proceedings of the Society.

Thursday, the 24th of July, 1879.

RAJAH SUTTYANUND GHOSAL, BAHADOOR, V. P., in the Chair.

The proceedings of the last meeting were read and confirmed.

The following gentlemen were elected Ordinary Members :—

Messrs. H. P. Rushton, G. R. Aberigh-Mackay, Sorabji Dadabhoy, A. C. Brett, J. B. Woosman, and J. C. Grieff.

Honorary Members.—Lieutenant-General Sir Arthur Phayre and Baron Ferdinand von Mueller.

The names of the following gentlemen were submitted for Membership :—

C. F. Worsly, Esq., C. S., Mozufferpore,—proposed by Mr. H. W. Stevens, seconded by the Secretary.

Rajah Muttobur Sing, Chowdree Bazar, Cuttack,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

Thomas Anderson, Esq., Merchant, Calcutta,—proposed by Mr. Leitch, seconded by Mr. S. H. Robinson.

O. H. Brookes, Esq., Settlement Officer, Port Blair,—proposed by the Secretary, seconded by Mr. R. Blechynden.

E. D. M. Hooper, Esq., Forest Department, Nagpore,—proposed by Dr. G. King, seconded by Mr. Robinson.

CONTRIBUTIONS.

1. Records of the Geological Survey of India, Vol. XII., Part 2. From Government of Bengal.

2. Memoirs of the Geological Survey of India. *Palæontologia Indica*, Ser. XII. From Government of Bengal.

3. The Saidapet Experimental Farm Guide and Manual. From Government of Madras.

4. Progress Reports of Forest Administration in British Burmah and in the Punjab for 1877-78. From Government of India.

5. Prices of Food Grains, Firewood and Salt in Bengal, for the years 1866 to 1878. From Government of Bengal.

6. Proceedings of the Asiatic Society of Bengal for May 1879. From the Society.

7. A small quantity of seeds of tuberous Begonias. From S. Jennings, Esq.

8. Seeds of trees of sorts from the Andamans. From E. H. Man, Esq.

9. A quantity of Mahogany seed and seed of *Bambusa stricta*. From Dr. G. King.

10. Ferns and other plants from the Neilgherries. From F. Lazarus, Esq.

GARDEN.

The Head Gardener's monthly report was read, of which the following are extracts:—

"The weather has been seasonable, and trees and shrubs in the Garden are reviving under the influence of the late copious showers and the heat combined. Our tanks are filling rapidly—our fences around the garden have been repaired. Rose layering was finished some time back—layers and cuttings of various kinds of flowering shrubs are also far advanced. Lichee 'gotees' commenced about a week ago.—Mango inarching will commence to-morrow. The increase of fruit trees should be one of our principal objects, as the demand for fruit trees seems on the increase this year as compared with last season; but our staff of males is meagre. Thousands of cuttings of ornamental leaved plants have been put down, a fuller list will be given next month. We have several thousands of young tamarinds which ought to be shifted soon as we require the space which they occupy; they are superior to the ordinary kind, the pulp being sweeter. We have received a small quantity of Messrs. Ohlendorff's manure. We have had no full opportunity as yet of trying its effects on various fruit trees, &c., but some ordinary native maize seed from Shahabad district was sown on 17th June 1879 on poor and overdamp land, and part received a mere sprinkling of this manure; the manured plants and unmanured ones are sent for inspection. [The one is twice the length of the other.] We also send a few flowers of double Hibiscus, namely, *H. rosa sinensis Kermisianus* and *Rosa sinensis minimus semiplenus*. Of contributions several kinds of the Andaman seeds have germinated:—*Vatica robusta*, *Urania Madagascariensis* and *Casuarina* seedlings received from Royal Botanic Gardens, Howrah, are all progressing favourably; a small collection of ferns in excellent condition have been received from Mr. F. Lazarus; *Reana luxurians* has been sown. The Mahogany seeds sown on 5th July germinated several days ago. Of *Coffea liberica* we have secured altogether about 120 seeds, a few of which have germinated; but as they take 6 or 8 weeks to germinate, we cannot yet form any opinion as to the number of plants we shall get finally."

HIMALAYAN ONION.

Read the following extract of a letter from Capt. J. F. Pogson:—

"By this day's pattern post I have despatched to your address a packet containing twelve roots of the onion indigenous to these hills. I believe they grow wild up in Kunawar.

"The botanical name *Allium leptophyllum*, does not appear in either the British or Indian Materia Medica, I have found it in 'Johnston's Chemistry of Common Life,' page 448, q. v.

"I should like these onions to be put down and propagated if feasible in Bengal.

"I tried four yesterday, minced up, and beaten into an omelette. The

taste was very good, but half an hour after eating it, I felt very warm and broke out into a very profuse perspiration, which could only have been due to the onions, as beyond pepper and salt nothing else was used in the preparation of the omlette.

"I tasted a good slice of the onion in its raw state. It was strong and very pungent, much more so than any common bazar onion of the plains.

"This sudorific quality is of value, for the onions (all the tribe) are most nourishing; and if the present variety is medicinally sudorific, it will meet and supply a long-felt want.

"I have put down a lot of roots, and hope by and bye to secure the seed.

"The favorite way of eating this *Allium* is to cut the green stems, and to grind them down into a paste on the curry stone, and then to use this leaf paste with other condiments in making up a curry, meat or vegetable."

The Secretary stated that these bulbs had been sent to the garden for immediate planting. He also called attention to a paper in the Society's Journal, Vol. II, p. 453 (old series) in which reference is made to the Himalayan Onion as of superior quality.

Letters were also submitted:—

1. From Messrs. Williamson Magor & Co., sending specimen of an insect which is doing much mischief to the tea bushes in the Munguldye Company's plantation.

2. From the Editor of the *India Tea Gazette*, specimen of what is described "as a new form of blight on tea bushes in Assam." The above have been forwarded to the kind care of Mr. Grote for the inspection of the Scientific Committee of the Royal Horticultural Society.

3. From R. Macallister, Esq., presenting some cobs of American Maize grown in a cold latitude to meet the request of Mr. Buck, as notified in last month's proceedings. These cobs were immediately forwarded to Mr. Buck who tenders his best thanks for Mr. Macallister's courtesy.

4. From H. A. Firth, Esq., submitting an account of a grand show of the Royal Agricultural Society of British Guiana. Some of the fruits and vegetables introduced in the schedule are, Mr. Firth observes, very like the products of Bengal.

5. From the Officiating Secretary to the Government of India, Home, Revenue, and Agricultural Departments, giving some information in respect to the introduction and culture in the Andamans of *Musa textilis*, of which a specimen of fibre, with report thereon, was submitted at the last Meeting.

6. From Capt. Pogson, a paper on the cultivation of Chicory, by India Tea, Coffee, and Cinchona Planters as an article of export to Europe.

The above two papers were transferred for publication in the Journal.

Thursday, the 21st of August, 1879.

BABOO PEABY CHAND MITTRA, in the Chair.

The Proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Rajah Muttobar Sing, Messrs. C. F. Worsley, Thomas Anderson, O. H. Brookes, and E. D. M. Hooper.

The names of the following gentlemen were submitted for Membership :—

The District Engineer, Mozufferpore,—proposed by the Secretary, seconded by Dr. S. Lynch.

F. D. Neish, Esq., Manager, Ramoo Tea Estate, Chittagong,—proposed by Mr. H. W. Barber, seconded by the Secretary.

Coomar Juggut Sing of Kashipore, N.-W. P.,—proposed by the Secretary, seconded by Baboo P. C. Mittra. •

Arthur C. Showers, Esq, Nonkacherra, Upper Assam,—proposed by Mr. St. G. A. Showers, seconded by the Secretary.

Dr. Vincent Richards, Goulundo,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

Rejoined.—Maharajah Coomar Harrendhur Kishore Sing Bahadoor, Bettiah, Tirhoot, and Rajah Ram Rutton Chuckerbutty, Hetampore.

CONTRIBUTIONS.

1. Progress Reports for 1877-78 of Forest Administration in Coorg, Mysore, Ajmere, Central Provinces, Hyderabad Assigned Districts, N.-W. P. and Oude. From Government of India.

2. Annual Report of the Agricultural Department of the Madras Presidency for the year ending 31st March 1879. From the Government of Madras.

3. Transactions of the Asiatic Society of Japan, Vol. 7, Part 3. From the Society.

4. The *Indian Forester*, Vol. V, Part 1. From the Editor.

5. Memoirs of the Geological Survey of India, Vol. 16, Part 1. From the Superintendent.

6. Proceedings of the Asiatic Society of Bengal, June 1879. From the Society.

7. An assortment of seeds of forest trees from the Andamans. From E. H. Man, Esq.

8. A small collection of seeds from the Acclimatisation Society of Queensland. From L. A. Bernays, Esq., V. P.

The following is extract of letter from Mr. Bernays respecting these seeds :—

“Herewith I send you two packages of seeds, viz., one containing *Eusephalatos Miquelii* and *Banksia collina*, one of the most beautiful of this beautiful family, and *Avicennia officinalis*. This last is the white mangrove which you may have. If not however I may say of it that though a tree of littoral habit,

it is capable of being handsomely grown away from the sea : the second package contains *Eucalyptus siderophloia*, and *E. Barleyana*. The first is the iron bark, the second a newly discovered species of last year, found on dry ridges."

9. A small packet of seed of *Zizania aquatica*, or wild rice of North America, described as splendid fodder grass for swamps in Upper India. From Baron F. von Mueller.

10. A bag of Egyptian Cotton seed. From J. C. Chapman, Esq., of Alexandria. Available to Members.

11. A small collection of seeds of useful trees from the Royal Botanic Garden, Calcutta. From the Superintendent.

12. A collection of Orchids and Ferns from Sylhet. From C. K. Hudson, Esq.

GARDEN.

The Head Gardener's monthly Report was read as follows:—

"Weather seasonable, but rainfall rather deficient; work progressing favourably in all directions. Layers, gooties, grafts, nearly finished. Peaches yet remain to be inarched, but our paucity of malees causes the work to go on but slowly. Of contributions, we have received seeds of palms, cycads, pandanus, &c., from Mr. E. H. Man, of Port Blair. The seeds from Queensland unfortunately died. Gloxinia, Begonia, &c., from Sutton and Sons duly sown. Valuable Palm seeds from Mauritius Botanic Garden. Also a selection of various trees, including *Bischofia javanica* from the Royal Botanic Gardens, Howrah. The outlay in the Gardens during the past month has been somewhat over the average, but is fully compensated for by the extra cleanly state of the garden; however I think we can reduce the establishment next month with safety. I herewith forward a flower of *Hibiscus rosea-sinensis collerii* for inspection. We have also received from Mr. Bull of Chelsea two cases of plants which includes a nice collection of Crotons, Dracaenas, Dieffenbachias, &c.; three plants only died out of a consignment of 120 plants. They were sent in Bull's patent cases which seem to be very suitable when combined with careful packing. We have received a collection of Cryptograms and Orchids from Mr. Hudson of Sylhet. Further and similar donations of such would be useful for distribution and for specimens."

SINGHARA NUT.

In his letter advising despatch of the seeds above noted, Mr. Bernays, Vice-President of the Queensland Acclimatisation Society, alludes to the particulars given in the last published number of this Society's Journal regarding the Singhara Nut. He writes as follows:—"I wish also to refer to Capt. Pogson's notes on the Singhara nut, because we have succeeded well in growing the species of *Trapa* known as *T. bicornis* but have met with a difficulty in harvesting the crop. It appears to us to be an annual plant, and seems to disappear and the nuts sink to the bottom before they are fit for gathering. There is, I think, an

important future for the *Trapas* in Australia, and we therefore want all the information possible about them. Can you resolve my difficulty and further say, if Capt. Pogson proposes to sow his crops annually on the water, or expects them to re-appear from sunken nuts. We have not got the species known as *Trapa bispinosa*, but should much like to have it." The Secretary mentioned he had communicated with Capt. Pogson on the subject.

PECULIARITIES IN CERTAIN VARIETIES OF THE PINE APPLE. .

In another part of his communication already referred to, Mr. Bernays alludes to a notice recently published by the Society of a peculiar Pine Apple from Sylhet, in the following words:—

"I have to thank you much for Part I of Vol VI of your Journal, which is full of interest for us. At page 46 I find notice of a peculiar pine apple from Mymensing. The enclosed extract may throw some light on this subject. It is taken from a letter written to us a few years since by Mr. Hugh Low then of Labuan, now Government Resident at Perak in the Malay Peninsula. The pine-apples in question have with us only partially developed the peculiarity referred to, but our soil at Bowen Park is quite unsuited for them, while the moist heat of Borneo may also have some influence in giving this multiple character described."

Extract referred to in Mr. Bernay's letter of 16th June 1872:—

"The multiple pine is a marvellous object. My attention was first directed to the search for it by the late Dr. Lindley, but I was many years looking for it in the Straits, when at last I found it in a Chinese garden; instead of the usual shoots at the base of the fruit, it bears small pine-apples of about six ounces in weight, each with its crown, and as there are a great many of them and the main fruit is a large one of the sugar-loaf kind, it becomes a magnificent object on a large table."

APPLICATIONS FOR SEED OF PITHECOLOBIUM SAMAN.

The Secretary mentioned that he had recently had numerous applications from Members and others from various parts of the country for seed of this cattle fodder yielding tree, the *Guango* of Jamaica, but had been able to meet them only partially, in consequence of all the seed in his possession having been distributed. He had, however, applied to the Superintendent of the Royal Botanic Garden, at Ceylon, for a further supply of seed of this useful tree, and hoped on receipt to meet all applications.

TOBACCO FROM COOCH BEHAR.

Read a letter from Messrs. Gillanders, Arbuthnot & Co., submitting for report and valuation some tobacco grown and cured in Cooch Behar, under the superintendence of an expert from Manilla, on which Messrs. Anderson, Wright & Co. had kindly made the following remarks:—

"We are in receipt of your favor of date, and have carefully inspected the

musters of tobacco. These seem well cured and show a fine rich leaf, but as we have so often had to point out when referring to such musters, there is no market for this style of leaf. If the expert who has prepared the tobacco can transform the leaf into cigars that can be smoked, he will find a large consumption for them, but no one wants Indian leaf tobacco of this stamp. English manufacturers will not take a present of it, as it won't carry enough of water, and Continental buyers are just as well pleased with ordinary native poolia."

Letters were submitted:—

From E. Buck, Esq., requesting on behalf of a correspondent, particulars in respect to the cultivation of the pine-apple in Pilibheet. (Complied with).

From the Superintendent of the Benares Jail, a sketch of the "Benares Jail Plough" with directions for its use.

From the Secretary Department of Agriculture, Melbourne, returning thanks for a copy of the last published number of the Journal, Vol. VI., Part 1.

From the Agent, E. I. Railway, regrets he is unable to sanction the free carriage of trees, &c., required to line public roads at various stations on the line of railway.

INDIAN WHEAT.

Referring to the Blue Book recently published, containing a full report by Dr. Forbes Watson on Indian Wheat, the Secretary drew the attention of the Meeting to the steps taken by this Society, many years ago (1843), regarding this important staple, as shewn in the voluminous correspondence and papers connected with the cultivation and production of Wheat in India as published in its Journal, Vol. III, old series. Also to the Petitions subsequently presented to both houses of Parliament on the justice and expediency of allowing the admission, into the ports of Great Britain, of wheat from this country, on the same terms as had then been conceded to wheat from Canada. The wheat of the Punjab was not then taken into consideration, but it was shewn what fine varieties were raised in certain parts of India—especially the Central Provinces,—and that the establishment of an export trade from India in corn was even then pregnant with advantages to the country, notwithstanding the difficulties which then existed, but most of which have since been removed by the formation of railroads and more rapid steam communication with Europe.

DEVELOPMENT OF THE WILD SILK INDUSTRY OF INDIA.

The subject which next came under consideration had reference to the wild silk industry of India, as embodied in the supplement to the *Gazette* of India of 2nd August. The Secretary called to the notice of the Meeting the fact that, as in the case of wheat, the improvement of the wild silks of India—Tussur, Eria, Moongah, and others, had engaged the attention of this Society at various times for the past forty years, as a reference to its Transactions and Journal would shew. So long since as 1839 the Society offered a reward for promoting the cultivation

of the Eria worm and the reeling of its silk. Nearly every volume from that time till recently contains notices on the wild silk worms of India, including several able papers by the late Capt. Thomas Hutton of Mussoorie. The trials now making by Mr. Wardle and others in the same direction are very encouraging towards the development of an industry which will probably, ere long, become one of great importance.

The Secretary placed on the table several flowers of double Balsam of many colors, some very brilliant, raised in his garden from the imported seed which had been so largely distributed to Members at the commencement of the rainy season.

Thursday, the 25th of September, 1879.

RAJAH SUTTYANUND GHOSAL BAHADOOR, *V. P.*, in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected members :—

The District Engineer, Mozuffpore, Coomar Juggut Sing, Dr. Vincent Richards, Messrs F. D. Neish and Arthur C. Showers.

The names of the following gentlemen were submitted for membership :—

J. Gannon, Esq., La Martinicre, Lucknow,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Baboo Greeshunder Mookerjee Calcutta,—proposed by Baboo Peary Chand Mittra, seconded by Baboo Protapa Chandra Ghosa.

The Chief of Kagul, near Kolapore,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

Major G. A. Way, D. A. A. General, Jubbulpore,—proposed by the Secretary, seconded by Mr. H. J. Leitch.

Manager, Darjeeling Tea and Cinchona Association,—proposed by Mr. H. F. Brown, seconded by Baboo P. C. Mittra.

E. P. Wood, Esq., Barrister-at-Law, Calcutta,—proposed by Mr. C. T. Davis, seconded by the Secretary.

The Rev H. P. Boerresen, Nya Doomka,—proposed by Mr. W. M. Smith, seconded by Mr. R. Bignell.

R. Webster, Esq., Damer, by Bagdogra,—proposed by the Secretary seconded by Mr. MacLachlan.

Rejoined.—H. E. Thompson, Esq., Superintendent Government Telegraphs, Akyab; W. S. Mackenzie, Esq., of Jeetwanpore, Tirhoot, and Ernest Newton, Esq., Pleader, Allahabad.

CONTRIBUTIONS.

1. Review of the Forest Administration in India for 1877-78. From the Government of India.

2. Records of the Geological Survey of India, Part 3, Vol. 12, and Memoirs, *Palæontologia Indica*, Vol. 1. 4. From the Government of Bengal.

3. Report on Government Botanic Garden, Peradenia, Ceylon, for 1878. From the Director.

4. Report on Government Botanic Garden, Saharanpore and Mussoorie, for year ending 30th June 1879. From the Superintendent.

5. Report on the Acclimatisation Society of Queensland for 1878. From the Society.

6. Report on the Botanic Garden at Singapore for 1878. From the Superintendent.

7. Journal, Royal Horticultural Society of London, Part 8, Vol. 5. From the Society.

8. Journal Asiatic Society of Bengal, Part 1, Nos. 1 and 2, Part 2, No. 2, and Proceedings for July 1879. From the Society.

9. A glazed case of Plants of *Araucarias* of sorts, &c., and seed of *Panax elegantissima*. From the Queensland Acclimatisation Society.

10. Further supply of seeds and plants from the Nicobar Islands. From E. H. Man. Esq.

11. A plant of *Accacia Arabica* var. *cupressiformis*, and seedling of *Poirrea coccinea*. From G. Bartlett, Esq.

12. Seed of *Eucalyptus gomphoccephala*, valuable for timber. From the Baron F. von Mueller.

13. A small quantity of seed of the "Guango," (*Inga Pithecolobium Saman*). From Dr. G. H. K. Thwaites.

14. Seed of the Golden Millet of the United States. From Mr. G. Buist.

Mr. Buist regrets his inability to send seed of *Catalpa bignonioides* as requested on the suggestion of Mr. J. H. Bridgman. (See Proceedings of May last).

GARDEN.

The Head Gardener's monthly report was read as follows:—

Rainfall has been deficient this last month, but has been partly compensated for by the many cloudy days which we have had, during which evaporation was reduced to a minimum. The tank near the principal gate has considerably more water in it this year than last; this is accounted for by having had drains cut from various low-lying parts of the garden to the tank, alike beneficial to the tank, and the part drained. As cutting up the roads makes the garden look unsightly, I shall take the first opportunity of placing large drain pipes under the several roadways as a permanent measure. Work somewhat similar to last month: gootees are being potted off, various cuttings made, general cleaning up of the garden, and delivery orders as brisk as ever. We have planted out a lot of *Araucaria Cunninghamii*, each about five feet high, and *H. Bidwillii* two feet high, in various conspicuous places in the gardens. We have about twenty large plants yet remaining, part of which I intend to transfer

into tubs for specimens. Palms of various kinds have also been planted out in the garden grounds; a couple of large Palms have been successfully removed from near the west gate to the margin of the rose garden tank, and placed in prominent positions. Contributions during the month have been a collection of seeds from Botanic Garden Capetown, of which some may succeed probably, but I am afraid will not live long, the temperature here being too high. *Boccania Japonica* sown several times, but has not germinated. Andaman seeds from Mr. Man, also 44 pots of unnamed and mixed plants from the same source. Seventy *Persea gratissima* seeds duly sown on day of receipt and covered with wire netting to prevent jackals from scratching them all out. These animals are very troublesome in the garden destroying seeds, fruits, and anything they can manage to get at, even digging into the rose-beds and cutting off the roots of the roses in their endeavours to make an excavation,—with no apparent object. Palm seeds from Mauritius Botanic Garden, these contributions are exceedingly useful. Concerning the germination of Mahogany seeds supplied I find that the Bombay (Genesh Khind Botanic Garden) have germinated 4 per cent., and the Botanic Garden, Howrah, first consignment 16 per cent. The 10 lbs. of Mahogany seeds subsequently received, roughly calculated to contain about 17,000 seeds, have only produced 15 seedlings.

We have in hand about 200 nice plants of *Pithecolobium saman*, the seed of which was received from Royal Botanic Garden, Howrah, and which germinated freely; these plants are now suitable for distribution. We have planted out some of the largest for permanent stock.

We have obtained a fresh lot of *Caladiums* by purchase, some of them are similar to our old stock which were almost exhausted last year by sales: the other section are kinds not in the catalogue, and may be distributed next spring.

Concerning the plants received from Mr. Bull, the following have died, up to date, as under; however I do not expect further losses:—No. 34, *Passiflora anabilis*; No. 36, *Passiflora Bijou*; No. 45, *Peperomia velutina*; No. 105, *Æchmœa Veitchii*.

The remainder are doing well and will be changed into larger pots, as they have started growth freely.

In respect to the glazed case from Queensland, I find the *Araucaria Cunninghamii* all right, *H. Bidwillii* only one dead. *A. Cookii* 47 barely alive and 92 quite dead; the Orchids rather weakly, the *Dendrobium linguiformis* dying soon after exposure to our moist air. The Rajah Suttayanund Ghosal, Bahadoor, of Bhookoylas, has presented to the garden a nice collection of plants, including 37 plants of *Poincœa coccinea*, 6 *Magnolia pumila*, &c."

REMEDY FOR COFFEE BLIGHTS, A PROBABLE APPLICABILITY
FOR TEA BLIGHTS.

Read a letter from Messrs. Macneill and Co., enclosing extracts from papers

regarding the disease by which Coffee plants are attacked and its cure. "It has occurred to us," observe Messrs. Macneill, "that this would probably be as effectual in destroying blight in Tea plants, and we purpose recommending it to the Managers of several of our Gardens, but as you will see the mode of its application is not very clearly expressed, and we would feel obliged if you would be kind enough to ascertain from some one in Ceylon, where you have no doubt correspondents, as full information as possible on the subject."

The Secretary mentioned that he had lost no time, on receipt of the above communication, in sending copies of the extracts to Mr. D. Morris, the Assistant Director of the Botanic Garden at Ceylon, who has been for some time past devoting his attention to a remedy for the *Hemileia*, and requesting as full information as possible in connection with Messrs. Macneill and Co.'s particular enquiry. He had not yet received a reply.

TEA BLIGHTS.

Read a letter from Mr. Arthur Grote, acknowledging receipt of a specimen submitted in July last, from the Editor of the India *Tea Gazette*, and described "as a new form of blight on tea bushes in Assam." Mr. Grote mentions that this is identified by Mr. F. Moore of the India Museum as "a species of *Diapromorpha*, of which genus you sent home another species some 6 or 7 years back. I cannot refer to the Proceedings at this moment, but I think Moore called the latter *D. melanopus*, and the beetle now sent is nearly allied to it."

The following is extract from the Proceedings of February 1873 of the communication from Mr. Moore alluded to by Mr. Grote:—

"The insect, which your correspondent of the Moran Tea Co., Cachar, states attacks and destroys the young Pekoe shoots, is the same species of Beetle named *Diapromorpha melanopus*, that caused so much damage on the Cossipore Tea Estate in 1869, as noticed in the Society's Proceedings for November of that year. The only remedy that is at all likely to prove successful is that of having the tea plants carefully and regularly looked over several times during the day, and all insects found upon the plants picked off and instantly killed by pressing them between the fingers. This operation should form a part of the regular daily work of the hands on the plantation."

THE ARGAN TREE OF MOROCCO.

The Secretary submitted a note from Mr. E. C. Buck, Director of Agriculture, N.-W. P., asking for seeds of the "Argan tree" described in the *Gardener's Chronicle* of the 2nd August, as a useful oil and food-producing tree of Morocco—"It is stated that seeds have been supplied to various parts of the East Indies. Are you aware whether the tree has been anywhere successfully raised in this country?"

The Secretary mentioned that Mr. Scott of the Royal Botanic Garden, Calcutta, does not remember having seen any plants of this tree (*Elaeodendron*

Argan) in their gardens, nor can he trace the receipt of any seeds. Not having been able to trace its receipt in any other quarter, he (the Secretary) had addressed Sir Joseph Hooker on the subject, and applied for seeds.

CHOCOLATE TREE.

Read an application from Mr. W. Aitchison of the Dooloo Gardens, Cachar, applying for seeds or seedlings of the Cacao or Chocolate tree for introduction into his district.

The Secretary mentioned that trees were raised in former years in the old garden of the Society, but they never fruited and eventually died down. Mr. Scott had informed him that there are now a few specimens in the Royal Botanic Garden which, though now and then producing flowers, have not as yet borne fruit. Having observed in the last published report of the Royal Botanic Gardens of Peradeniya, Ceylon (see following extract) that the Chocolate tree had been successfully cultivated there, he had applied to Dr. Thwaites for seeds as soon as available:—

“*Chocolate (Cacao)*—The cultivation of this very useful plant may now be considered thoroughly well established in the warmer parts of the Island. The native villagers even are adopting its cultivation to some degree. As an additional number of trees in this Garden are now coming into bearing, we shall soon have a larger supply of seeds than hitherto, to meet the considerable demands made upon us for them. In our tropical Garden at Hewaragoda the Chocolate tree thrives most luxuriantly, and we have been able to form a small plantation there of the paler fruited Caraccas kind, with its cream-coloured variety. Seeds of these we hope to distribute in moderate quantity in a year or two. Our anxiety is to obtain from Trinidad the most esteemed varieties of chocolate in cultivation there. Cultivators of Cacao must bear in mind how much the value of the commercial product depends upon the adopting the proper system of fermentation of the contents of the ripe freshly gathered pods, and the subsequent thorough drying of the seeds or nibs.”

The Secretary placed on the table further numerous applications for seeds of the Guango (*Pithecolobium saman*) which he had been able to meet partially through the kind assistance of Dr. Thwaites, and hoped to meet fully on receipt of the promised further supply.

Thursday, the 20th of November, 1879.

RAJAH PUTTYANUND GHOSAL BAHADOOR, F. P., in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—

Buboo Greeschunder Mookerjee; the Chief of Kagul; Major G. A. Way; Munger Darjeeling Tea and Cinchona Association; Rev. H. P. Boerresen, Messrs. J. Gannon, E. P. Wood, and R. Webster. ♀

The names of the following gentlemen were submitted for Membership :—

H. F. L. Dodsworth, Esq., Oorjee Factory, Azimgurh,—proposed by the Secretary, seconded by Mr. S. H. Robinson.

Baboo Suraj Deb Narain Sing, of Bulgarh, Tirhoot,—proposed by Mr. T. M. Francis, seconded by the Secretary.

P. Dickens, Esq., c. s., Nuddea,—proposed by the Hon'ble L. Tottenham, seconded by Mr. Robinson.

J. M. Gordon, Esq., Hissar,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Geo. Udney Yule, Esq., Merchant, Calcutta,—proposed by Mr. Cogswell, seconded by Mr. W. Stalkartt.

Geo. Kennett Lyon, Esq., c. s., Rungpore,—proposed by Dr. R. D. Ghose, seconded by Mr. Cogswell.

A. H. Pirie, Esq., Professor Canning College, Lucknow,—proposed by the Secretary, seconded by Mr. Cogswell.

Koomar Maharnjuh of Vinianagram,—proposed by Rajah Suttayanund Ghosal, seconded by Baboo P. C. Mittra.

Rejoined.—J. C. Murray, Esq.

CONTRIBUTIONS.

1. A descriptive Atlas of the Eucalypts of Australia, First and Second Decades—by Sir Ferdinand Baron von Mueller. From the Author.
2. Report on Indian Wheat—by Dr. Forbes Watson. From Government of India.
3. Annual Report on the Government Experimental Farms, Cawnpore and Allahabad, for 1877-78. From Government North-Western Provinces.
4. Report of the Commissioner of Agriculture, of the United States, for 1877. From the Commissioner.
5. The *Indian Forester*, Vol. VI. From the Editor.
6. Proceedings Asiatic Society of Bengal, for August 1879. From the Society.
7. A plant of *Kigelia pinnata*. From Mr. R. M. Daly.
8. An assortment of Ferns from Ootacamund. From Mr. F. A. Lazarus.
9. Ferns from Darjeeling. From Mr. John Lynam.
10. Shoots of the Martaban Plantain. From Mr. C. Ady of Moulmein.
11. Seed of *Panax elegans* from Queensland. From Mr. L. A. Bernays.
12. A tree fern from Darjeeling. From Mr. H. Kean, c. s.
13. Plants of *Bolbophyllum Beccarii*, from Borneo. From Mr. H. J. Murtop, Superintendent Botanic Garden, Singapore.
14. Collections of seeds and plants from the Nicobars. From Mr. E. H. Man.

GARDEN.

The Head Gardener's monthly report was read, of which the following are extracts :—

"The weather during the past two months has been dry, and the opportunity thus offered of cleaning up the Garden after the rains has been accepted as far as possible. Various rough-growing plants of little interest in any light have been cleared away with the object of supplanting them by species of greater popularity. Several common kinds of Crotons have been placed in tubs for the purpose of displaying the variegation of the leaves in the full grown plants; a few leaves of *C Youngii* sent for inspection. [These are about two feet in length and beautifully marked.] We have a fine collection of Palms and fruit trees on hand for distribution. The flower garden is being prepared, and I hope to have it ready as soon as possible. The Liberian Coffee seedlings are progressing favourably and promise to make healthy plants in a short time. A site for a new Rose Garden is urgently required, the most suitable place for that purpose being the central grass plot in the garden. Concerning contributions, we have received amongst others as below :—"*Kigelia pinnata*"—from Mr. R. M. Daly; "*Cyrtodeira fulgida*"—from Mr. J. Scott; "two strong plants of "Golden Ferns"—from Mr. W. F. Westfield.

"Of Seeds : the Palm seeds from Mauritius have germinated very fairly; the seeds seem to have been selected with care. The germination of vegetable and flower seeds, as far as ascertained, are herewith sent."

From the tabular statement referred to in the above report, it appears that of the English vegetable seeds five have not germinated, whilst the others (smaller seeds) have given a general average of 38 per cent. Of the American vegetable seeds, some 7 or 8 kinds have not germinated, whilst the others have given 24 per cent. Of English flower seeds two have failed, and some of the others have yielded but a small percentage; remainder have given a fair return. The result of the acclimated flower seeds has not proved satisfactory.

Letters were read from Lieut.-General Sir Arthur Phayre and Sir Ferdinand Baron von Mueller in acknowledgment of their election as Honorary Members. The Baron writes—"I appreciate this mode of distinction all the more, as I have comparatively done so little to advance the special interests of your important union; but I can assure you that I have watched with pleasure and with advantage to myself the strides made by your Society in enhancing the cultural resources of India and in diffusing a taste for refined Horticultural pursuits also in the great Indian Empire."

TEA FROM YUNAN.

Mr. Locke, Secretary of the Economic Museum, forwarded for the inspection of Members a sample of "Puerh" tea, grown in the south of Yunan. The tea is stated by Her Majesty's Consul at Shanghai to be "highly valued at the Court of Peking, and by the Chinese generally for its invigorating properties."

It is also said to be "much appreciated in Thibet and to command a large market in that country." The sample in question, weighing about ten ounces, is prepared in a peculiar quoit-like form. Mr. Locke mentions that it has been submitted to a well-known Firm of Tea Brokers in Calcutta, who report on its description to the following effect—"Compressed leaf; thin, extra common, and old liquor; out of condition. This ten, in its present condition, would be unsaleable in the market. The sample must have been kept in a damp place, or come in contact with water, as it smells quite musty, like *damaged tea*."

**A SUGGESTED REMEDY FOR COFFEE BLIGHTS,—PROBABLE APPLICABILITY
FOR TEA BLIGHTS.**

The Secretary recalled attention to the letter from Messrs. Macneill and Co. on the above subject which was submitted at the last Meeting. His application to Mr. D. Morris, the Assistant Director of the Royal Botanic Garden at Peradeniya, Ceylon, having been returned, in consequence of the departure of that gentleman for England, he had addressed Dr. Thwaytes, the Director, on the subject, who had obligingly sent him a printed copy of his remarks on the Coffee leaf disease. The following extracts, which he would now read, would tend to shew that the external application of sulphur is not likely to be so effective, as supposed, in mitigating the ravages of Coffee leaf disease. Whether it would be more efficacious in respect to tea blights, remains to be seen :—

"The want of success which has attended the recent attempts to check the progress of the leaf disease, by the application of sulphur and lime, seems to render it desirable that I should make some observations on the subject.

"It may be remembered that towards the end of the year 1869 the presence of some kind of disease, which proved to be the *Hemileia vastatrix*, was announced as present upon a few coffee plants on an estate at Madulsima. During the following year this fungus was detected at Peradeniya—a distance of about a hundred miles—and neighbouring places, still only in small quantity; but during the next year the *Hemileia* occurred over considerable areas in the Central Province.

"The spread of the disease over such large areas in so short a time must no doubt have been due to the presence of inconceivably minute germs floating in the atmosphere and carried by the wind.

"The subsequent development of the *Hemileia* filaments can have borne but a small part at first in the propagation of the pest. After a time, however, these filaments were doubtless an important element in the rapid spreading or rather aggravation of the disease in certain areas.

"It was to destroy these filaments with their supposed spore-producing capabilities that the treatment by sulphur and lime was adopted. This treatment, though efficient in performing the work proposed, has however, so far

proved quite a failure in checking materially the propagation of the disease itself. Notwithstanding that the *Hemileia* filaments upon the plants were destroyed as expected, it soon became evident that the disease itself was not checked; for, the succeeding young foliage immediately shewed signs of incipient disease, and this not resulting from the action of *Hemileia* filaments, for these had been destroyed and none could be detected, but from some source which can only be attributed to latent infection in the coffee plants, or to the operation of the same minute germs supposed to be injuriously active during the first spread of the *Hemileia* in the island.

"I am disposed to believe that the *Hemileia* filaments themselves do not remain in an active living state for more than one season, but that, as there is no doubt that the spores continue in a living condition for a much longer time, it is very desirable that the fallen coffee leaves with the spores upon them, as well as the ground underneath the trees, be well treated with hot lime in order not only to benefit the trees themselves, but to kill the spores before new active development take place to do mischief in the next season of growth.

"I therefore feel it my duty to give it as my opinion that, judging from the serious effects produced, the external application of sulphur is hardly likely to be effective in curing, or in even mitigating to any very satisfactory extent the ravages of the leaf-disease; and that it will have to be ascertained by very careful conscientiously conducted experiments, if any temporary benefit in the way of production of crop would be likely to result from the application of certain manures to the roots of the coffee trees."

THE ARGAN TREE OF MOROCCO.

The Secretary also recalled to the notice of Members a communication on the above subject from the Director of Agriculture, N.-W. P., as read at the last Meeting. He had recently received a reply from the Assistant Director, Royal Gardens, Kew, to whom he had referred. Mr. Dyer writes—"The notice of the Argan tree in the *Gardener's Chronicle* is an old story taken out of the appendix to Sir Joseph Hooker's book on Morocco. The distribution of seeds referred to took place many years ago, and we have none now to give away. If you wish to procure a supply, your best plan would be to apply to R. Drummond Hay, Esq., Vice-Consul at Mogador."

FODDER GRASSES AND OTHER ECONOMIC PLANTS.

Read a letter from J. H. Bridgman, Esq., respecting Fodder Grasses, of which the following are extracts. The Secretary remarked that he had already addressed Dr. Schomburgk on the subject:—

"You will remember that in April last I wrote to you quoting a passage from the *Pioneer* of the previous October in praise of a timber tree called the *Catalpa Bignonioides*. Three weeks ago the *Pioneer* had another article on the subject, from which it appears that it is extensively grown in the 'Western States'

(of America)? and is 'to be' largely cultivated in Australia. Apparently Dr. Schomburgk is the authority from whom this information is derived, and for the interesting description given of the plant, which represents it as one of the most valuable trees in existence. I have cut out from the paper the passage in which the information is afforded. The article refers also to other plants which I conceive will deserve your attention, particularly the fodder plants, of one of these, that which is the most praised, viz., the *Panicum spectabile*, you sent me some seeds some years ago, which I sowed, but the produce by no means deserved the encomiums bestowed upon it. The plant had a hard woody stalk and a harsh leaf which the cattle would hardly touch, and I gave up its cultivation in consequence. I have thought it possible that some mistake may have been made in the seed sent to me, for I think that no one could possibly describe the plant which grew in my ground as a valuable fodder plant. Dr. Schomburgk speaks so highly of it, that if there can be any doubt upon the subject, it would be quite worth trying it again."

INTRODUCTION OF INDIAN SEED POTATOS INTO GREAT BRITAIN.

Mr. Allen Stokes, a Member of the Society, submits the following extract of a letter from a gentleman of some local standing in Cork regarding seed potatoes, raised in India, for trial in Ireland :—

"I think we should import from some place where there is no disease, and I think you have none in India. Is this the case? and if so, will you let me know if I could manage 3 or 400 tons, the cost, the kind you would recommend, and if you can learn, would they keep for so long a voyage?"

And Mr. Stokes adds—"I shall be much obliged to you, or any of your correspondents, for any information on this point, which, to the enquirer, may prove of great value."

The Secretary added that he had received a communication from another Member (Mr. Hindmarsh) now absent, on behalf of a friend in England, for potatoes, though to a much smaller extent. Mr. Hindmarsh observes—"There has been a great deficiency in all crops this year, the corn fully 30 per cent. under the average. Root crops 50 per cent., and potatoes are so much diseased that in many places they are not worth lifting; in fact the absence of sunshine, a low temperature and excess of rain, have prevented healthy development both in farm crops and in fruit; altogether it has been a most disastrous season."

Resolved.—That these extracts be introduced in this day's proceedings with the view of eliciting information thereon.

REPORT ON JUTE RAISED IN THE VICINITY OF CALCUTTA.

Mr. Sterndale, Vice-Chairman of the Suburban Municipality, submits some fibre raised on municipal land by a native cultivator, and requests an opinion on quality and value. Mr. W. H. Cogswell, a member of the Fibre Committee, has kindly responded to this request in the following words :—

"The sample of 'Bun pat' Jute you have sent me is well known to the natives of Bengal, being a self-sown, wild, jungly plant. It might have been much better prepared; the staple is short, irregular, very harsh, towy, but of fair strength. On such a sample it is difficult to put a correct valuation, but it is probably worth about Rs. 3 to Rs. 3-2 per bazar maund."

Letters were read—

1. From the Director, Department of Agriculture, N.-W. Provinces, forwarding a copy of correspondence on the subject of Mulberry tree cultivation, and requesting any further procurable information on the subject.

2. From the Manager, Muir Mills Company, Cawnpore, requesting information in respect to Silk-worms' eggs for Australia. Mr. Smith adds—"As this is a subject that is not altogether of a personal nature but one that may lead to beneficial results to a whole Colony, I trust you will excuse my troubling you on the subject."

The Secretary intimated he had been able to meet both the above enquiries through the kind assistance of Mr. C. E. Blechynden, who had much practical knowledge on the subject.

3. From Offg. Under Secretary to the Government of India, Home and Agricultural Department, sending some further particulars regarding the cultivation of the Vanilla Hemp in the Andamans.

4. From J. F. Duthie, Esq., Saharanpore, enclosing a translation from the Italian of a paper on the Carob tree (*Ceratonia siliqua*). The above two papers were transferred for the Journal.

5. From the Acting Superintendent Government Farms, Madras Presidency, applying for copies of the Society's publications. To be complied with.

6. From the Director Royal Botanic Garden, Mauritius, returning thanks for certain publications of the Society.

Thursday, the 18th of December, 1879.

THE HON'BLE LOUIS JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

Messrs. H. F. L. Dodsworth; P. Dickens, C. S.; J. M. Gordon; G. U. Yule; G. K. Lyon, C. S.; A. H. Pirie; Baboo Serraj Deb Narain Sing, and Koomar Maharajah of Vizianagram.

The names of the following gentlemen were submitted for Membership :—

James F. Smart, Esq., Manager Balajan Factory, Noacherra Tea Co., Assam,—proposed by Dr. C. J. Simons, seconded by the Secretary.

Sheik Atta Hosen, Small Cause Court, Choadanga,—proposed by the Secretary, seconded by Mr. W. Waterfield.

Dr. W. H. Gregg, Civil Surgeon of Hooghly,—proposed by Mr. T. E. Ravenshaw, seconded by the Secretary.

Geo. Elphinstone Keith, Esq., Merchant, Calcutta,—proposed by Mr. H. J. Leitch, seconded by Mr. W. H. Cogswell.

Rejoined.—H. C. Mahony, Esq., Tea Planter, Toklai Tea Factory, Jorehat, Assam.

CONTRIBUTIONS.

1. Progress Reports of the Forest Administration 1878-79, in Bengal, British Burmah, and Coorg. From Government of India.

2. Memoirs of the Geological Survey of India, Vol. 18, Part 2, Geology of Western Sind. From the Superintendent.

3. Transactions of the Asiatic Society of Japan, Vol. 7, Part 4. From the Society.

4. Journal of the Asiatic Society of Bengal, No. 3 of Part 2, and No. 3 of Part 1. From the Society.

5. Wild Silks and Dye Stuffs of India, by Thomas Wardle. From the Author.

6. The "Bharatya Granthabali," Vol. 1, by Rajendro Nath Dutta. From the Author.

The Baboo also presents a few seeds of certain useful kinds of plants.

7. A further collection of seeds and plants from the Nicobars. From E. H. Man, Esq.

8. A quart of the seed of *Sorghum saccharatum*. From W. F. Grahame, Esq., C. S.

Mr. Grahame mentions that this quantity is one-third of the product of 100 seeds sown in the beginning of the hot weather last year. One seed yielded nearly 2,400 seeds.

9. A case of plants from Brisbane, from L. A. Bernays, Esq., V. P., Queensland Acclimatisation Society.

10. Plants of Begonia, *Richardia Ethiopica*, Violets and Iris. From T. M. Francis, Esq.

It was agreed, on the recommendation of the Council, that orders similar to last season be given for vegetable and flower seeds from England and America for 1880.

Further, that an exhibition of vegetables and fruits and flowers be held early part of next year, the former in January and the latter in February.

GARDEN.

The Head Gardener's monthly report was submitted as follows:—

"The weather in regard to temperature has been seasonable, but the rainfall has been insufficient for successful garden operations. The principal labour in the garden has been taking off Rose layers, and layers of various other orna-

mental plants and potting off young plants which have been propagated. We commenced repairing the principal paths throughout the garden sometime ago: the huge brickbats, which prevented the paths being travelled over with any comfort, have been removed from the centre of the path, and are being utilized for a new road in course of construction in the south-east corner of the garden, to an old gateway there; this road will be very useful, as manure and house rubbish on arrival will be deposited in the rubbish yard adjacent to this road, and thus save the cutting up by the carts of the garden paths after repair. We have also been engaged cutting and clearing away various shrubs of jungle origin which, though they might have been found useful at first for the purpose of filling up bare spaces, can be spared now, with advantage. Seeds have been sown in south flower garden and are germinating well. Various kinds of annuals, sown sometime ago have been planted out in suitable places around the grounds. Many of the large beds around the lawn which, up to the present, have been occupied with inconspicuous plants in regard to beauty, have been planted out with large sized Crotons, which, when well into growth, will prove very effective. Sowings of various contributed seeds have been carried out as usual, and also the potting of those which have germinated. We have repotted the young plants of the forbidden fruit which were raised from seed supplied by Col. W. M. Lees in 1878-79. At first, on germination, many of the seedlings were entirely denuded of leaves by the larvae of *Papilio Pammon*, and in consequence many died; still we have been able to save about 113 plants, which are ready for distribution. We have also a nice lot of *Pithecolobium Saman* plant just suitable for planting out. I omitted to mention that the road leading from the Belvedere grounds on the north-east has also been newly laid. Concerning the Ferns presented by Mr. F. Lazarus, a few are doing fairly, but somehow the Ferns sent us from Darjeeling by Mr. J. Lyman, have unfortunately not succeeded. This, I am surprised at, as they seemed so fresh on arrival and have moreover had the same treatment and position as the others. Contributions during the month were as follows:—The tenth consignment of Andaman seeds of which the *Palmaceæ* and *Pandanaceæ* germinate fairly: other miscellaneous seeds have not succeeded so well. A small collection of bulbs from Mr. Bull which have been duly potted off. A collection of choice flower seeds from Messrs. Sutton and Sons of Reading, sown in south flower garden. Palm seeds from Mauritius Botanic Garden also sown. A climbing Fern (*Lygodium* ?) sent by Mr. O. H. Brookes, Andamans. A case of Croton cuttings from the Queensland Acclimatisation Society; many of these are rooted slightly, but have lost all their foliage. If slight ventilation had been provided for, I think they would have arrived in better condition. Also received 6 plants of *Poireia coccinea*, presented by Mr. G. D. Vere, Bhowanipora.

TEA FROM THE ANDAMANS.

A report from Messrs. Moran and Co., altogether favorable, on a sample of tea from the Andamans, forwarded by Mr. O. H. Brookes, Settlement Officer, was submitted. It was agreed that this sample, the first received of the growth of the Andamans, be transferred for deposit in the Economic Museum.

FIBRE FROM KUMAON.

Mr. J. G. Bellairs, of Chowkooree Tea Factory, Almora, Kumaon, submitted certain samples of fibre and a small specimen of cloth made therefrom, with the following remarks thereon :—

“ I am sending you down by post to-day samples of a fibre procured from a plant grown on this estate, and shall be glad to know what you think of the fibre, and whether in your opinion it would sell in Calcutta or London and at what price.

“ Sample C. is the fibre ready for market unhackeled.

„ A. is the same fibre after hackeling.

„ B. is Tow taken out of A. in hackeling, it has not been whipped.

“ I have tested the fibre against that of rhea and find what I send you far the strongest and for work under water. I question if anything will impair it. *Carefully* twist up a thread to say No. 50 cotton size, and you will have some idea of the strength of the fibre. Fishing twine made of it I find stronger and more lasting than *any* English made line I have ever seen weight for weight and length for length. For working up into dress stuff alone or with other material I think the fibre will prove of value. I am now making in a rough loom coarse cloth, and a sample I will later on send you.

“ I am prepared to place a few tons of the fibre on the London market, if the reports I receive on the fibre lead me to think the venture likely to succeed, and if the trial shipment paid I could send any quantity yearly, as the plant from which the fibre is taken, grows most kindly in this soil, in fact the quantity will be merely a question of capital.”

Read the following minutes of the Fibre Committee on the above samples : —

Mr. John Stalkartt.—I believe this fibre is obtained from a species of nettle and have seen something like it in the Darjeeling Hills, but there it was very difficult to clean.

I think it very valuable, and that it ought to be sent to England for valuation to some silk factory, or to some of the makers of the higher description of linen or fancy goods ; articles that ladies wear.

Mr. S. H. Robinson.—This is no doubt from one of the nettle tribe, very like rhea, but the combed fibre is coarser, about double the size of the rhea under the microscope. The question as to its economical value depends entirely on the cost of its production, and Mr. Bellairs should let us know at what price per

maund it could be laid down in Calcutta: it is much too coarse for use as a cotton, but could probably be put to the same uses as rhea.

Mr. W. H. Cogswell.—I think the fibre is produced from the nettle, which, in some of the Hill districts, grows to a great extent and is very luxuriant in the rainy season. It has been well prepared, but I think the colour might have been improved on. It is of good length, very soft, almost silky, and of great strength. I have not a sample of rhea fibre by me for comparison, but I am of opinion that this is not so valuable as the rhea.

It would be unsaleable in this market, but I recommend a very large sample shipment of it to be made to London to some flax-spinner whose opinion would be valuable in all respects and its correct value readily ascertained. It ought to pay as a cultivation, but Mr. Bellairs will doubtless furnish the Society with some details and also a specimen of the plant, with its flower also, if possible.

Resolved—That copies of the above be sent to Mr. Bellairs, and his attention requested to the recommendations contained therein.

TEA BLIGHTS.

Read the following extract of a letter from Mr. A. Grote, in reference to the specimens of blights and insects referred to in the Proceedings of June and July last:—

"I saw Mr. Moore to-day and shewed him the specimens of blights and insects enclosed in your tin box. The so-called blight sent to you by Mr. Pinney is the larva of a Flata which covers itself with those long white plumes. It is an Homopterous insect allied to the wax insect of China, and the plumed larva is always to be found in the insect collections sent down in boxes from Eastern Bengal. Feeding, as it does, on jungle plants, it will prove probably to have been only an accidental visitor to Mr. Pinney's tea garden."

"The green beetle sent to you by the Munguldye Company is a *Curculio* allied as Moore thinks to *C. tanymecus*, but these beetles ordinarily bore into the stems and branches of plants and do not meddle with their leaves. Of those last you sent me some specimens, which undoubtedly had been pierced by insects; but is it certain that this particular beetle did the mischief? Our scientific Committee has not yet commenced its sittings, and I have therefore been unable to consult them. Still the whole family of weevils should, if possible, be kept out of Tea Gardens. I hope Mr. Pinney and the Munguldye Manager will keep you informed if these pests show themselves a second year."

In connection with the above the Secretary submitted the following extract of a letter from the Manager of the Kunchunpore Tea Company (Cachar) regarding the Mosquito blight:—

"With reference to your letter of 14th instant, regarding the cure of blight on the Lydicharra Tea Estate by cutting the jungle round the tea, I beg

to inform you it has been tried on various gardens without the least effect every year since 1867, and the Estate mentioned not having suffered severely this year is one of the peculiarities of blight which baffles all attempts at understanding it. I know gardens that have no jungle whatever round the tea, it having been all cleared out, yet the blight is as bad as when the jungle was there. With reference to next year, I have not experienced two successive years of severe blight, and there is no doubt the drought, &c., had a great deal to do with its being so severe, and we are not likely to have two successive bad seasons either: a good one has hitherto followed a bad, as witness 1867, 1868, 1870, 1871, 1875 and 1876. With reference to the cure of blight, all we have found out is that it is an insect resembling the mosquito, and as numerous; any number can be seen any day sucking the juice of the young leaves, but where it lives, lays its eggs, &c., and at what season, is only a conjecture. The loss by this pest is so enormous that those interested in tea should combine and get a first class Entomologist to reside for a season in the tea districts and study and find out the habits, &c., of the insect; that known I think the cure would easily be found, and I think it is the first thing to be done. I know Managers who would forfeit six months' pay if they did not make over a third more tea if blight was cured, and I know Companies who lose from 40,000 to 50,000 annually by blight alone."

VALUE OF THE JUICE OF EUPHORBIA AS A PROTECTION FOR IRON WORK.

Read a letter from Col. W. M. Lees, dated Torquay, 6th November, of which the following is an extract:—

"I send you a cutting from the *Times*, as I am under the impression that some of the *Euphorbiaceæ* grow as a weed in India, and as I remember some rather costly experiments being made at Calcutta to protect iron against corrosion and marine growth, the subject might be worth considering."

"THE EUPHORBIA.—Some few years since a survey was being carried out in Natal for the Colonial Government, during which it was discovered by one of the officers engaged on the work that when certain plants belonging to the natural order *Euphorbiaceæ* were cut with the clearing knives, the gum which exuded from the plants adhered firmly to the blades, and was very difficult to remove. It was moreover found that the knives so coated did not rust, and this led to further experiments being made with the view of utilizing the gum as a preservative material. Iron plates were coated with the gum and subjected to immersion in the waters of South Africa, which are stated to be proverbial for their foulness and for the rapidity of the growth of vegetation. The euphorbia in Natal grows in close contiguity to the sea-shore, so that there was ample opportunity for securely testing its value as a protective covering for iron against corrosion and marine growth. The experiments proving perfectly success

Proceedings of the Society

ful it was then sought to put the discovery into a practical form. To this end the gum was dissolved in a preparation of spirits, and this was found to be a ready means of applying it as a coating for ships' bottoms and for ironwork generally requiring such protection, the spirits evaporating and the gum being left on the surface of the metal. With this preparation experiments were made a few years since by Sir Andrew Clark, C. B. who had a sheet of iron coated with it and placed in the waters in Her Majesty's dockyard at Chatham, where anything immersed becomes rapidly fouled. At the end of two years the sheet of iron was taken out and was found to be quite clean and free from fouling and corrosion. The composition has also been successfully tested in Africa against the ravages of the white ant. This success is attributed to the circumstance that the gum of the euphorbia which forms the base of the fluid, is of such an intensely bitter nature that it paralyzes the efforts of all insects to attach themselves to it or to bore into any substance coated with it. These successes have led to its adoption in practice for the purposes above indicated, and it is now being introduced in England. We have examined several applications of this composition, which gives a glossy coating alike impervious to air or moisture while according to results its own peculiar protective property remains unimpaired."

Letters were read—

From Under Secretary, Government of India, Home, Revenue, and Agricultural Department, forwarding copy of a communication from H. B. Majesty's Consul at Manilla, regarding the cultivation of the *Musa textilis*.

From the same, a report from the Director, Department of Agriculture, N. W. P., on the experimental cultivation of *Euchlœna luxurians* during the year 1878-79.

From the Director, Department of Agriculture, N.-W. P., respecting a process of grafting as communicated by the Superintendent of the Government Farm at Allahabad.

The above were transferred for publication in the Journal.

Mr. W. Chick forwarded for the inspection of the Meeting one of his "patent economic ploughs," cost Rs. 11-8. Mr. Chick states that this plough weighs only 35 lbs. as against a hundred weight, the average minimum weight of an English plough. Though more expensive than the primitive plough of the country, he remarks that it will last four times longer, and can be easily drawn by native cattle.

REPORT
OF THE
Agricultural and Horticultural Society
OF
INDIA
FOR 1879.

*Report from the Council at the Annual General Meeting, held on
the 26th February, 1880.*

The Council submit to the Members their report on the operations of the Society during 1879.

The number of new members elected (75) is more than in 1878; the resignations (41) are also less. The number removed for non-payment of subscriptions (51) is about the same as last year; for deaths (17*) which are more numerous than in 1878, and 13 for long absence from the country. These reduce the numbers to 643, classified as follows: viz., 28 Life-Members; Honorary, Associate, and Corresponding 19, and nominal paying Members 596. Of this number 52 are absent from India, and 59 have failed to contribute in 1879; this reducing the actual effective number of paying Members to 485.

The distribution of Members, as they now stand, is shewn by

* Messrs. F. L. Beaufort, J. A. F. Hawkins, Robert Lowther, the Maharajah of Burdwan, Ameer Ali Khan, Messrs. W. G. Amos, Geo. Butt, R. Crisp, W. Cumming, T. Determes, M. Hartnell, F. Jennings, W. Ridge, G. M. Smith, J. Vernon, Mrs. E. Sandys, and the Maharajah of Vizianagram.

the following list. Of the whole, 125 are resident in Calcutta, 444 in other parts of the country, and 74 in Europe:—

CLASSIFICATION.	In 50 previous years.	In 1871.	In 1872.	In 1873.	In 1874.	In 1875.	In 1876.	In 1877.	In 1878.	In 1879.	Gross Total.	Total real number at the close of 1879 after deducting lapses.
Honorary Members ...	20	2	0	0	0	1	1	0	0	2	26	11
Associate „ ...	6	0	0	0	0	0	0	0	0	0	6	2
Corresponding „ ...	14	0	0	0	1	0	0	0	0	0	15	7
Civilians, Covenanted & Uncovenanted ...	69	24	14	10	14	16	14	5	6	5	801	66
Merchants and Traders ...	606	14	10	10	18	15	9	2	4	7	695	83
Agriculturists ...	596	22	27	19	41	90	30	31	17	20	893	223
Military Officers ...	639	34	12	15	4	4	6	4	4	6	728	63
Medical „ ...	223	8	8	7	6	7	5	2	4	2	278	34
Asiatics „ ...	267	16	8	8	25	10	15	19	8	14	390	91
Clergy ...	39	0	1	1	0	0	0	0	0	1	42	4
Law Officers ...	121	4	4	2	6	6	1	0	4	2	150	23
Miscellaneous, Police, Civil Engineers, &c. ...	137	9	3	17	8	12	10	17	18	16	247	88
Total ...	3,367	133	87	89	312	161	91	80	65	75	4,271	643

There is not much to notice in respect to the financial position. The expenditure has been almost the same, though there has been an increase on account of the annual show and on the Building (Metcalf Hall) in consequence of arrears of taxes, which had been allowed by the Municipality to accumulate on the previous year.

There is, however, one item of Rs. 366 for law charges. Such an item has never previously appeared in the books of the Society. It has occurred in consequence of a complaint brought against a native nurseryman, Boomun Mohun Roy of Chella, (which is within a short distance of the Society's Garden) in whose possession certain rare plants were discovered which were found to be the property of the Society, and accordingly restored. The Deputy Magistrate who tried the case, however, did not consider it proved that the receiver had purchased with a guilty knowledge, and he was consequently acquitted.

The cash balance in the Bank of Bengal (3,429) and arrears, of subscription, &c., (2,597) amounting to 6,026, will after deducting the liabilities, (3,083) shew a balance in favor of the Society of Rs. 2,943.

Of the amount of arrears (2,096) of the past 4 years, 1875-78, Rs. 1,068 have been collected in 1879. The arrears for 1879, on 31st December, amount to Rs. 1,562.

The annual exhibition of vegetables, fruits and flowers was held in the Garden in the early part of the year. It was on a more extended scale than that of 1878, which consisted of flowers only. The attendance was fair—probably about one thousand—both of members and the general public. The expenditure for contingent ordinary items exceeded somewhat the amount received by sale of tickets to non-Members. The judges reported favorably of the show in general.

The usual annual importations of vegetables, flower and field seeds from England, America and Australia were received and widely distributed. With exception of some of the smaller packets from America the result seems to have been satisfactory. An assortment of acclimatized flower seeds from the Lucknow Horticultural Garden, of the kinds usually grown in our gardens, was also received. These seeds have been indented for the last three years on the recommendation of a former President. They have generally germinated freely; but a complaint having been recently preferred by a resident Member as to their worthlessness, enquiries have been made to a few non-resident Members who are known to be good gardeners, and the result has proved most favorable.

The demand by Members for plants from the Garden has been rather greater than in the previous year. The returns of delivery orders amount to 240, but in addition thereto, about 70 supplementary orders have been issued, which is also greater than heretofore; 8,300 ornamental plants have been distributed to Members in part return of their subscription. There has also been a sale to members and the public of 2,000 economic plants and 2,900 fruit grafts, besides many cuttings of plants. Among other general ordinary work there has been an unusually large propagation of plants, in order that the stock for distribution during 1880 may more adequately meet the requirements of Members; though several kinds noted in the catalogue have been worn out or entirely lost by drought and other causes. Various large show plants of Araucarias, Crotons and Palms, which have become too large for pots have been placed in the Garden grounds in substitution of other more ordinary plants for which the demand is now very limited. The roads throughout a portion of the Garden, the roughness of which has been a subject of complaint, have been improved by the removal of metal which was originally put down of too great a size and in too large quantities. The drainage has also been carefully attended to, whereby a larger quantity of water will flow into the tanks. There is, however, still room for improvement in this

Report of the Agricultural.

respect, so as to obtain the *desideratum*, as abundant a supply of water as possible for the continual requirement of the large and annually increasing stock of pot plants. A consignment of ornamental plants, from Mr. Bull of Chelsea, was received in excellent condition during the rainy season. These will in time constitute a valuable addition to the general stock for distribution to Members. There has been a fair demand for economic plants—notably Mahogany and Coffee—both the Arabian and Liberian varieties of the latter. Attempts to raise the latter by cuttings have been but partially successful, while the seeds take a much longer time to ripen and to germinate than the ordinary kinds. The stock of sugar-canes of better kinds having been exhausted, an application has been made to Mauritius for another supply, as there is a constant demand for them.

The thanks of the Council are due to several contributors of plants and seeds—among them the Queensland Acclimatisation Society, Mauritius Botanic Garden, Calcutta Botanic Garden, Baron Ferdinand von Mueller, Rajah Suttanund Ghosal, Bahadur, V. P., Messrs. C. K. Hudson, T. M. Francois, and E. H. Man. The latter gentleman has most obligingly sent ten consignments of plants and seeds from the Andamans and Nicobars, of which the Palms are especially acceptable.

Applications for seeds of economic plants have continued throughout the year, especially for tobacco, Carolina paddy, flax, maize, cereals, mahogany, Guinea and other fodder grasses; also for *Pithecolobium Saman* and *Euchlœna luxurians*. For the latter useful grass the demand has been very great and has been fully met in the shape of seeds and plants.

It was stated in the last report that the Society had been reluctantly compelled to abandon altogether, for want of support on the part of those most interested, a scheme towards a full enquiry for the investigation of various blights affecting the tea plant. The several applications made to the Society during the past year for information in connection with insect pests of various kinds, and the serious ravages, greater than ever, committed during 1879, and consequent decrease of produce, on gardens both in Assam and Cachar, shew still more forcibly the necessity for close and careful investigation. The question of a proposed remedy for the ravages of the Coffee blight, (*Hemileia vastatrix*) as probably applicable to tea blights, was moved at a recent monthly meeting; but it seems doubtful, on further investigation and trials, whether the external application of sulphur "is likely to be effective in curing, or in even mitigating to any very satisfactory extent the ravages of the [coffee] leaf disease."

From the monthly proceedings of the past year it will be seen that among other matters, reports have been furnished on sundry

specimens of field produce, including tobacco, cotton and fibres of sorts; further, that notices have been introduced respecting the development of the wild silk industry of India, and Indian wheats, subjects which in past years engaged considerably the attention of the Society. It is satisfactory to find that the former is now likely to be fully utilized in a variety of ways, and that the export trade of the latter is annually becoming more important.

Only one Number of the Journal was published during the year, Vol. VI, Part 1. Part 2 is now in the press, and will be distributed to Members in the early part of 1880.

*Statement of Receipts and Disbursements of the AGRICULTURAL AND
HORTICULTURAL SOCIETY OF INDIA, from 1st January to 31st
December, 1879.*

RECEIPTS.

From Members, Subscriptions collected during the year	...	...	...	16,099	13	6
„ Proceeds of country vegetable, acclimated flower and other seeds	...	532	12	0		
„ Proceeds of surplus stock of American and English vegetable and English and German flower seeds, and Melbourne field seeds, &c.	3,179	0	0			
				3,711	12	0
„ Government—Proceeds of surplus stock of American vegetable and acclimated flower seeds, and of English vegetable and flower seeds specially imported for H. M.'s Soldiers' Gardens	...	1,650	0	0		
				5,361	12	0
„ Proceeds of copies of Journals of the Society	42	0	0			
„ Proceeds of copies of other publications of the Society	...	34	0	0		
				76	0	0
„ Proceeds of admission Tickets for non-Members to the vegetable and flower show held in January	...	224	0	0		
And President's donation	...	27	0	0		
				251	0	0
„ Amount of freight repaid	...	...		554	7	3
„ Amount of suspense account in deposit for appropriation on various accounts	...	...		73	0	0
„ Amount of packing and forwarding charges on seeds, plants, &c.	...	...		2,268	5	0
„ Garden—Proceeds of fruit grafts	...	563	8	0		
Proceeds of ornamental plants	2,135	14	0			
				2,699	6	0
Proceeds of boxes, pots, and Wardian cases..	347	2	0			
Amount of cooly-hire for packing plants, &c. &c.	...	112	8	0		
				3,159	0	0
Total, Ordinary Receipts, Rs.	...	...	...	27,848	5	9

EXTRAORDINARY RECEIPTS.

From Government of Bengal—Donation from December 1878 to November 1879	...	2,400	0	0		
„ Rent of large room of the Hall from December 1878 to November 1879	...	1,200	0	0		
Rent of stable from February to May 1879	...	40	0	0		
				3,640	0	0
Total, Rs.	...	...	...	31,488	5	9
Balance in the Bank of Bengal on 31st December 1878	...	...	...	4,818	13	7

1.

Statement.

DISBURSEMENTS.

SEED ACCOUNT.

By Messrs. Vilmorin Andrieux & Co., balance for consignments of seeds received in 1878..	288	4	9
„ Robert Buist, Jr., for ditto ditto and in part for 1879	4,354	13	2
„ Messrs. Sutton & Sons for ditto ditto for account of the Society	8,937	11	7
And in full for ditto ditto imported for Government...	1,268	4	0
	5,205	15	7
„ W. Adamson in full for consignment of seeds from Australia received in 1879	225	10	2
„ Horticultural Garden, Oudh, on account ditto for acclimatised flower seeds	551	4	6
„ Sundry parties for country vegetable seeds, &c. &c.	176	14	0
	10,802	14	2

LIBRARY ACCOUNT.

„ Messrs. H. S. King & Co., for sundry publications	145	8	6
„ Sundry parties for books purchased	13	14	0
„ Duffry for binding books	26	12	0
	186	2	6

PRINTING ACCOUNT.

„ Sundry parties for printing money receipts, annual reports, letters of call, &c. &c.	44	14	0
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FURNITURE ACCOUNT.

„ Sundry parties for purchasing and repairing furniture	24	8	0
--	----	---	---

ESTABLISHMENT ACCOUNT.

„ Office Establishment, from December 1878 to November 1879	8,678	6	3
--	-------	---	---

ADVERTISEMENT ACCOUNT.

„ Advertising notices of Meetings, seeds for distribution, surplus seeds for sale, &c. &c.	138	10	9
---	-----	----	---

FREIGHT ACCOUNT.

„ Freight paid on packages of seeds, plants, &c., sent to Members	641	14	3
--	-----	----	---

METCALFE HALL ACCOUNT.

„ Proportion of house rates from July 1878 to September 1879, and Police, Lighting, and Water-rates from October 1878 to December 1879	789	12	0
„ Matting and sundry petty works to the Building	24	7	6
	814	3	6
Ra. ...	21,331	9	6

Statement.

H.

Brought forward ... 21,831 9 5

STATIONERY ACCOUNT.

By Sundry parties for Stationery purchased ... 48 0 0

REFUND ACCOUNT.

„ Amount refunded, balance of account due to Members ... 48 0 0

JOURNAL ACCOUNT.

„ Messrs. T. Black & Co., for printing 750 copies of Journal, Vol. VI, Part I ... 414 8 0

VEGETABLE AND FLOWER SHOW ACCOUNT.

„ Prizes distributed to Mallees, for exhibiting flowers ... 223 0 0
Ditto ditto vegetables ... 227 0 0
450 0 0
„ Advertizing, printing, carriage-hire, fee for Band, hire of tents, and sundry expenses incurred ... 334 7 0
784 7 0

PETTY CHARGES ACCOUNT.

„ Postage on letters, circulars, Journals, &c. ... 170 9 0
„ Punkawallahs, carriage, boat and cooly-hire, extra packermen, landing and forwarding charges, cost of wax-cloth, oil-cloth, twine, tin boxes for acclimated flower seeds, &c. &c. ... 423 3 3
592 12 3
Rs. ... 23,212 9 8

GARDEN ACCOUNT.

„ Cost of sundry materials for propagation of roses, fruit grafts, orchids, &c. ... 433 7 6
„ Cost of tools, implements, and contingencies, including assessment on garden house, and service tax ... 899 1 0
„ Cost of boxes and pots purchased 439 14 0
1,772 6 6
„ Salary of Head Gardener, from December 1878 to November 1879 ... 2,400 0 0
„ Wages of Native Establishment, mallies, coolies, &c. ... 3,645 5 8
„ Messrs. Fleury & Co., balance for repairing Gardener's house ... 282 0 0
„ Law expenses and carriage-hire in the case for robbery of plants from Garden ... 366 6 0
Rs. ... 8,466 1 9 23,212 9 8

Statement.

Brought forward ... 8,436 1 9 23,212 9 8

PLANT ACCOUNT.

By Mr. W. Bull, for consignment of plants received from him ...	812 14 10						
„ Sundry parties for fruit seed- lings, Liberian coffee plants, Caladiums, &c. &c. ...	881 2 9	1,194	1 7				
					9,660	3 4	
Total Expenditure, Rs. ...					32,872	13 0	
„ Balance in the Bank of Bengal on 31st Decem- ber 1879 ...					3,429	6 4	
GRAND TOTAL, Rupees ...					36,302	3 4	

MEMORANDUM.

DISBURSEMENTS.				RECEIPTS.			
To amount of Ordinary Disbursements during the year 1879, as per Statement ..				By Balance in the Bank of Bengal on 31st December 1878 ..			
" Amount of Garden expenditure during the year 1879, as per Statement ..				" Amount of ordinary Receipts during the year 1879, as per Statement ..			
" Amount of cost of plants purchased 1,194 1 7				" Amount of Extraordinary Receipts during the year as per ditto ..			
Total, Rs. ..			9,660 3 4	GRAND TOTAL, Rupees ..			4,818 13 7
Balance in the Bank of Bengal on 31st December 1879 ..			32,872 13 0	GRAND TOTAL, Rupees ..			31,485 6 9
" ..			3,429 6 4	ASSETS.			30,302 3 4
Amount of Cash Balance ..			3,429 6 4	Amount of Cash Balance ..			3,429 6 4
Balance of subscription, &c., due from Members from 1875 to 1878 ..			1,035 5 3	Balance of subscription, &c., due from Members from 1875 to 1878 ..			1,035 5 3
Ditto ditto in 1878, as follows:—				Ditto ditto in 1878, as follows:—			
Balance of subscription, Rs. 780 10 3				Balance of subscription, Rs. 780 10 3			
freights, &c. ..			781 10 0	freights, &c. ..			781 10 0
GRAND TOTAL, Rupees ..			1,562 4 8	TOTAL, Rupees ..			2,587 9 6
Memo:				Memo:			
Society's proportion cost of erecting the Metcalfe Hall ..			23,537 15 9	Society's proportion cost of erecting the Metcalfe Hall ..			23,537 15 9
In landed property including Building at Alipore ..			20,646 6 0	In landed property including Building at Alipore ..			20,646 6 0
Grant Testimonial Fund invested in Govt. Securities ..			3,300 0 0	Grant Testimonial Fund invested in Govt. Securities ..			3,300 0 0
Exchange @ 1s. 8d. for the Rupee ..			5,083 2 4	Exchange @ 1s. 8d. for the Rupee ..			47,504 5 9

Statement.

111.

LIST OF MEMBERS.

OF THE

Agricultural and Horticultural Society

OF

INDIA.

DECEMBER 31st, 1880.

ALPHABETICALLY ARRANGED,

CLASSIFIED,

AND

DISTINGUISHING THE YEAR OF ADMISSION.

Office Bearers.

President

Vice Presidents :

W. H. COGSWELL, Esq.
W. STALKARTT, Esq.

RAJAH SUTTYANUND GHOSAL
BAHADOOR.
BABOO PEARY CHAND MITTRA.

Secretary and Treasurer :

A. H. BLECHYNDEN, Esq.

Members of Council :

R. BLECHYNDEN, Esq.
J. W. O'KEEFE, Esq.
DR. S. LYNCH.
BABOO PROTAPA CHUNDRA GHOSA
J. E. MACLACHLAN, Esq.
DR. GEO. KING.
S. H. ROBINSON, Esq.
H. J. LEITCH, Esq.
J. MARTIN, Esq.
G. L. KEMP, Esq.

List of Members.

* This mark denotes Members who are absent from India, and therefore non-contributors.

† This mark denotes Members, who, though absent, are desirous of continuing their subscriptions.

HONORARY MEMBERS.

Don Ramon de la Sagra, Island of Cuba	...	...	•
The Right Hon'ble Sir Lawrence Peel, London	1842	1856	
A. Grote, Esq., London	...	1837	1868
The Revd. T. A. C. Firminger, London	...	1851	1868
5 Baboo Peary Chand Mittra, Calcutta	...	1847	1871
J. A. Crawford, Esq., London	...	1857	1874
Lieut.-Genl. Sir Arthur Phayre, G. C. M. G., K. C. S. I.	...	...	1879
Baron Ferdinand von Mueller, K. C. M. G., M. & Ph. D.,	...	...	...
F. R. S.	...	...	1879
Jackson, Sir L. S., London	...	1852	1880
10 Pogson, Capt. J. F., Kotegurh	...	1879	1880

CORRESPONDING MEMBERS.

D. J. MacGowan, Esq., M. D., Ningpo	...	...	1851
Mons. Natalis Rondot, Paris	...	...	1858
Lieut.-Col. W. H. Lowther	...	...	1864
Dr. H. Cleghorn, Stravithie, St. Andrews, N. B.	...	...	1867
15 Vause Fretwell, Esq., Supdt. of Model Farms at	...	...	...
Bhurgaums, Kandeish	...	...	1869
C. Brownlow, Esq., Cachar	...	...	1870
Samuel Jennings, Esq., London	...	...	1874

ASSOCIATE MEMBERS.

Capt. E. P. Nisbet, London	...	...	1842
Geo. Bartlett, Esq., Calcutta	...	...	1870

LIFE MEMBERS.

20 Anund Rao Puar, His Highness, the Rajah of Dhar,	...	...	...
Dhar, <i>vid</i> Indore, C. I. E.	...	...	1872
Bentall,* Edward, Esq.	...	...	1837
Bhopal, H. H. the Begum of	...	...	1870
Bhowany Sing, Maharajah, Duttes	...	...	1864
Bishop,* Major H. P. (Artillery)	...	...	1853
25 Bishnath Sing, Rajah Bahadoor, Chief of Chutter-	...	...	...
pore, Bundelkund	...	...	1875
Brodie,* Major T.	...	...	1836
Buller,* Frederic Pole, Esq.	...	...	1837
Carew,† R. R., Esq.	...	...	1846

LIFE MEMBERS.—(Continued.)

		<i>Admitted.</i>
	Chhat Sing, Bahadoor, Maharajah of Samthar ...	1877
30	Chatter Patti Rao, Jagirdar of Alipoorah ...	1876
	Gopaul Sing, Rajah of Jabocah, <i>viâ</i> Indore ...	1874
	Maharajah, H. H., of Burdwan ...	1880
	Maharajah, H. H., of Churkari, Bundelkhund ...	1880
	Maharajah, H. H., of Travancore, Trevandrum ...	1880
35	Maharajah of Johore ...	1868
	Manackjee Rustomjee, Esq., Merchant, Calcutta ...	1837
	Mohender Pertab Singh, Maharajah, Bahadoor of Orcha, Tehri ...	1876
	Muhammud Hussin Khan Bahadoor, Nawab-zada of Baonie ...	1877
	Munsier Ali, H. H., The Nawab Nazim of Bengal ...	1874
40	Palmer,* T. A. G., Esq. ...	1861
	Richards,* J., Esq., Merchant ...	1834
	Roodurpurshand Chowdry, Nanpore, Tirhoot ...	1867
	Roop Deo, Rajah of Ali-Rajpore, <i>viâ</i> Sirdarpore, c. l. ...	1874
	Roordur Purtab Sing, Rajah Bahadoor, Dewan of Punna ...	1868
45	Suttyanundo Ghosal, Rajah Bahadoor, Bhookoylas, <i>Vice-President</i> ...	1869
	Thompson, Dr. R. F., Hooghly ...	1865
	Wigram,* Percy, Esq., c. s. ...	1871

ORDINARY MEMBERS.

	A.	<i>Admitted.</i>
	ABBOTT, Horace, Esq., Rajapore, <i>viâ</i> Koosteah ...	1858
	Abbott, H. E., Esq., Manager, Jaintpore Factory, Tirhoot ...	1874
50	Abdool Gunny, Kajee, Nawab, Zemindar, Dacca ...	1860
	Adkin,* H. A., Esq., Solicitor ...	1878
	Ady, Charles, Esq., Merchant, Moulmein ...	1864
	Ahmed, Dr. Z. A., Civil Surgeon, S. P. Doomka ...	1875
	Aitchison, W., Esq. Manager, Dooloo Tea Garden, Cachar ...	1869
55	Ainslie,* W. D., Esq. ...	1875
	Alexander, N. Stuart, Esq., c. s., Mymensing ...	1864
	Altaf Hossen Shaik, Moonshee, Hd. Clerk, Small Cause Court, Chooadangah ...	1880
	Anderson, T., Esq., Merchant, Calcutta ...	1879
	Andrews,* S. J., Esq., ...	1876
60	Angelo,* E., Esq., ...	1873
	Anthony, Adam, Esq., Deputy Accountant-General, ...	1870

A.—(Continued.)

		Admitted.
	Armstrong, Joseph Samuel, Esq., c. s., Pooree ...	1865
	Assistant Manager, Ting Ling Tea Co., Darjeeling	1875
	Assistant Manager, Singbulli and Nurmah Tea Co., Limited, Darjeeling ...	1875
65	Atkinson, Alex., Esq., c. s., Etah ...	1877

B.

	BALKRISHNA, Rai, Benares ...	1878
	Banon,* Lieut. A., 39th N. I. ...	1877
	Bannerman, Lt.-Col. P. W., Pol. Agent, Bhopal, Sehore	1876
	Barber, H. W., Esq., Deputy Magistrate, Chittagong	1875
70	Barker, Dr. R. A., Civil Surgeon, Bogra ...	1870
	Barlow, G. N., Esq., Civil Service, Bhaugulpore ...	1864
	Baron, Major W., Depy. Supdt. Revenue Survey 4th or Moradabad District, Nynsee Tal ...	1871
	Barstow, H. C., Esq., Civil Service, Cawnpore ...	1868
	Battersby*, Dr. W. E. ...	1878
75	Beadon, R. B., Esq., Hopjaun Porbot, Jaipore, Luckimpore, Assam ...	1879
	Beadon, W. A., Court, Esq., Supdt., Central Jail, Midnapore ...	1880
	Bean, Mrs E., Bankipore ...	1877
	Beaumont, Dr. Thomas, Residency Surgeon, Indore	1870
	Beckett, H. B., Esq., Depy. Commissioner, Dehra Ghazee Khan ...	1876
80	Beeby, G. O. Esq., Solicitor, Calcutta ...	1866
	Beezly J. L., Esq., Seleng Tea Coy., Jorehaut, Assam,	1879
	Behari Lall Pyne, Baboo, Calcutta ...	1876
	Bejoy Kissen Mookerjee, Baboo, Ooterpara ...	1880
	Reveridge, H. Esq., c. s., Bankipore ...	1865
85	Bholanath Dhur, Baboo, Merchant, Calcutta ...	1880
	Bhugwan Chunder Bose, Baboo, Calcutta ...	1875
	Bignell, R. A. D'O., Esq., Assistant Superintendent of Police, Patna ...	1867
	Bimala Churn Bhuttacharjee, Deputy Collector and Magistrate, Gya ...	1870
	Binning,* J., Esq. ...	1877
90	Blechynden, R., Esq., Merchant, Calcutta ...	1858
	Blechynden, A. H., Esq., Secretary, Agri-Hort. So- ciety of India, Calcutta ...	1851
	Blyth, W. D., Esq., c. s., Calcutta ...	1876
	Boddan,* Col. Hungerford, ...	1871
	Boerresen, The Rev. H. P., Ebenezer, Station, <i>via</i> Rampore Haut ...	1879
95	Bowers, Mrs., Bhuptani, Protanbgunge, Bhaugulpore	1872

B. — (Continued.)

		<i>Admitted.</i>
	Boxwell,* J., Esq., c. s. ...	1874
	Brae, T., Esq., Munjapara, Pubna ...	1854
	Brander, James, Esq., E. B. Railway, Sealdah ...	1865
	Brandis Dr. D., Inspector-General of Forests ...	1874
100	Branson, J. H., Esq., <i>Barrister-at-Law</i> , Calcutta ...	1874
	Brett, A. C., Esq., c. s., Jessore ...	1879
	Bridgman, J. H., Esq., Goruckpore ...	1868
	Brodhurst, M., Esq., Civil Service, Benares ...	1859
	Brookes, O. H. Esq., Settlement Officer, Port Blair ...	1879
105	Broucke, W. J., Esq., Indigo Planter, Bhugha Factory, <i>viâ</i> Chumparun ...	1859
	Brown, Forbes Scott, Esq., Merchant, Penang ...	1840
	Brown, H. F., Esq., Merchant, Calcutta ...	1875
	Browne, Lord Ulick, Civil Service, Rajshahye ...	1870
	Buck,† E. C., Esq., c. s. ...	1876
110	Buckingham, J., Esq., Manager, Amjoore Tea Estate, Assam ...	1879

C.

	CALDWELL, Jas., Esq., Emigration Agent, Natal, Garden Reach ...	1878
	Campbell,* D. W., Esq., Locomotive Supdt., E. I. Railway ...	1870
	Campbell, Lt.-Col. A. E., Depy. Commissioner, Seeb-saugor, Assam ...	1879
	Cantonment Magistrate, Cawnpore ...	1873
115	Cantonment Magistrate, Lucknow ...	1876
	Carew, B. H., Esq., Damdim, Julpigoree ...	1879
	Carnac, H. Rivett, Esq., c. s., Ghazeepore ...	1869
	Carshore, Walter, B., Urniah Factory, Shapore, Oonde, <i>viâ</i> Bajitpore, T. S. Railway ...	1875
	Castle, C. T., Esq., Dist. Supdt., Police, Budaon ...	1880
120	Chamarett, A., Esq., Surveyor-Genl.'s Dept., Calcutta ...	1874
	Chambers,* Chas., Esq. ...	1878
	Chapman,* A. W., Esq., Broker ...	1877
	Charriol,* F., Esq., Merchant ...	1875
	Chief of Kagul, Kagul, near Kolapore ...	1879
125	Chrestien, E., Esq., Bugha, Chumparun ...	1875
	Chunder Caunt Mookerjee, Baboo, Calcutta ...	1866
	Chunder Kirtee Singh, Maharajah of Mannipore ...	1874
	Clarke,* The Hon'ble Sir A., K. C. M. G., C. B. ...	1876
	Cogswell, W. H., Esq., Calcutta, <i>Vice-President</i> ...	1866
130	Cole, Rev. J., Supdt., Lawrence Asylum, Sanawur, near Kussowlie ...	1865
	Collier, F. R. S., Esq., c. s., Mozufferpore ...	1875

C.—(Continued.)

		<i>Admitted.</i>
	Cooke, Robin, Esq., Doolnbcherra, Cachar ...	1878
	Coombe, Dr. F. S., Jamalpore ...	1877
	Cornell, W., Esq., Civil Service, Midnapore ...	1861
135	Connell, Lieut. A., Asstt. Engineer, Fyzabad, Oudh...	1880
	Conroy, G. H. W., Esq., Calcutta ...	1879
	Coxhead, T. E., Esq., c. s., Dacca ...	1875
	Creaton, W. E., Esq., Merchant, Calcutta ...	1875
	Cresswell, W. S., Esq., Merchant, Calcutta ...	1874
140	Crowdy, L. J., Esq., Munjowl Factory, Beguserai, Monghyr ...	1875
	Cumming, J. J., Esq., Asstt., Messrs. Volkartt Bros., Kurrachee ...	1880
	Currie, G. M., Esq., Civil Service, Motihari, Chum- parun ...	1868

D.

	DALGAIRNS, Dr. A. F., 7th Regt, M. N. L., Berhampore	1879
	Dalgliesh, E. W., Esq., Tea Planter, Dulsing Serai, Tirhoot ...	1873
145	Dallas,* J. P., Esq. ...	1877
	Daly, R. M., Esq., H. M., Bengal Marine, Calcutta ..	1880
	Darwood, J. M., Esq., Rangoon ...	1878
	David, M., Esq., Dacca ...	1878
	Davis, C. T., Esq., Solicitor, Calcutta ...	1874
150	Davis, W. P., Esq., Bengal Police, Hooghly ...	1870
	Davidson, James, Esq., Debrooghur, Assam ...	1870
	Dear, Herschel, Esq., Monghyr ...	1860
	Deas, C., Esq., Calcutta ...	1874
	Denham, C. H., Esq., c. s., Howrah ...	1874
155	Deputy Commissioner of Sumbulpore ...	1866
	Deputy Commissioner of Ellichpore ...	1869
	Deputy Commissioner of Woon ...	1869
	Deputy Commissioner of Bassim, West Berar .	1871
	Deputy Commissioner of Akola, Berar ...	1875
160	Deveria, J., Esq., Calcutta ...	1880
	DeSouza,* The Hon'ble Sir W. E. ...	1878
	Dignam, S., Esq., Solicitor, Calcutta ...	1876
	Dickens, P., Esq., c. s., Nuddea ...	1879
	District Engineer, Mozufferpore, Tirhoot ...	1879
165	Dodsworth, H. F. L., Esq., Oorjee Factory, Azimgurh	1879
	Dodgson, W., Esq., Kallygunge Factory, Rungpore...	1864
	Dombal, Richard De, Esq., Manager, Hybutnugga Estate, Kishoregunge, Mymensing ...	1872
	Dombal, M. E., Durup-de, Esq., Mymensing ...	1876
	Doyal Chund Dass, Baboo, Banian, Calcutta ...	1877

			Admitted
170	Dunn,* Lieut. T. D. W., 62nd Regt. ...	...	187
	Dwarka Nath Dutt, Baboo ...	...	187
E.			
	EDEN, Hon'ble Sir A., Lieut-Gov., Bengal, Alipore..	...	187
	Edgar, E. L., Esq., Garden Reach ...	...	187
	Egerton, Hon'ble Sir R. E., Lieut-Govr., Punjab, Lahore ...	...	186
175	Eisenlohr,* F., Esq., Merchant ...	...	187
F.			
	FARQUHARSON, J. G., Esq., Nunmatty Factory, Gowhatty	...	188
	Firth, H. A., Esq., Emigration Agent, British Guiana, Garden Reach ...	...	187
	Fisher, Lieut-Col. G. B., Commandant, Fort Shah- kodar, Peshawar ...	...	186
	Fisher, J. H., Esq., c. s., Meerut ...	...	187
180	Foley, W., Esq., Tea Planter, Sylhet ...	...	187
	Forbes, A., Esq., Calcutta ...	...	187
	Francis, T. M., Esq., Solicitor, Mozufferpore, Tirhoot	...	187
	Fraser, Ronald, Manager, Margaret's Hope Tea Estate, Hope Town, Darjeeling ...	...	187
	Furrock Shah, Prince Mohammed, Russapugla ...	...	187
G.			
185	GALE, M. H. L., Esq., Pundowl Concern, Durbhanga	...	187
	Gannon, J., Esq., Lucknow ...	...	187
	Garbett, Major C. H., Asst. Commr., Chaibassa, Singbhoom ...	...	186
	Gardner, D. M., Esq., Civil Service, Banda ...	...	187
	Gardner, E. B., Dr., Civil Surgeon, Shajehanpore ...	...	187
190	Garth, Hon'ble Sir Richard, Chief Justice, High Court, Calcutta ...	...	187
	Gibbon, T. M., Esq., Betteah ...	...	187
	Gibbon, W. F., Esq., Senr., Doolah Factory, Gorruck- pore ...	...	187
	Gilman, J. H. S., Sonspore Tea Factory, Gowhatty...	...	187
	Gocool Nath Chatterjee, Baboo, Calcutta ...	...	187
195	Goonendro Nath Tagore, Baboo, Zemindar, Calcutta	...	187
	Gordon, D. T., Esq., Surdah ...	...	185
	Gordon,* John, Esq., Bank of Bengal, Calcutta ...	...	186
	Gordon,* Capt., A. Evans, Depy. Commr., Hill Tracts, Chittagong ...	...	187
	Gordon, J. M., Esq., Hissar ...	...	187
200	Grant,* Thomas, Esq., Indigo Planter...	...	184

G.—(Continued.)

		<i>Admitted.</i>
	Grant, G. H., Esq., Indigo Planter, Bhaugulpore ...	1859
	Grant, W. St. Clair, Esq., Latipore Concern, Bhaugulpore ...	1879
	Gray, Dr. E., Jorehaut, Assam ...	1875
	Gregg, Dr. W. H., Civil Surgeon, Hooghly ...	1860
205	Grey, * E., Esq., Civil Service ...	1868
	Grey, Capt. Henry, Loharduga ...	1878
	Greesh Chunder Mookerjee, Baboo, Calcutta ...	1879
	Grieff, J. C., Esq., Bareilly ...	1879
	Grija Prosunno Mookerjee, Baboo, Zemindar, Goberdanga ...	1878
210	Greenhill, T., Esq., Calcutta ...	1877
	Grierson, G. A., Esq., c.s., Backergunge ...	1877
	Griffiths, Ralph, Esq., Allahabad ...	1870
	Grimley, J. E., Supt., Nizam's Garden, Hyderabad ...	1875
	Grimwood, F. St. C., Esq., c. s., Debrughurh, Assam ...	1878

H.

215	HADENFELDT, * R., Esq., Merchant ...	1874
	Haines, H. E. Genl. Sir F. P., G. C. B., Commander-in-Chief ...	1878
	Halford, Charles, Esq., Bill-Broker, Calcutta ...	1872
	Harman, A. L., Esq., Jatepore Factory, Chupra ...	1876
	Harris, J., Esq., Koomtai Tea Estate, Badulipur, P. O., Assam ...	1877
220	Harrison, Augustus S., Esq., Principal of the Muir College, Allahabad ...	1873
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	Hawkins, R. W. L., Esq., Deoband, S. P. and D. Railway ...	1877
	Hay, John, Esq., Merchant, Calcutta ...	1876
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225	Head Gardener of the Ram Nawas, Jeypore ...	1876
	Health Officer, Calcutta ...	1865
	Helps, W., Esq., Manager, Fallowdhi Tea Co., Darjeeling ...	1875
	Henderson, Dr. Geo., Rawal Pindee ...	1876
	Hilaire, Louis de Saint, Esq., Merchant, Chittagong ...	1879
230	Hill, Dr. J. H. G., Turcooleah Factory, Moteeharee, Chumparan ...	1865
	Hill, R. H., Esq., Seraba, Tirhoot ...	1865
	Hobson, E. A., Esq., Merchant, Calcutta ...	1875
	Hogg, Major T. W., Asst. Commissioner, Jubbulpore ...	1868
	Holmes, A. B., Esq., Blackburn Tea Estate, Debrughur ...	1880

H.—(Continued.)

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235	Hooper, E. D. M., Esq., Forest Department, Nagpore	1879
	Hudson, C. K., Esq., Cheerapoonjee ...	1874
	Hughes, Mrs. A. J., Muzufferpore ...	1880
	Hunter, J. K., Esq., Koopili Tea Estate, Assam ...	1870
	Hurrender Kishore Singh, Bahadoor, Maharaj Coomar, Bettiah ...	1879
240	Hutchinson, Jas., Esq., M. A., Old Salona, Kobaoom, Assam ...	1880

I.

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	Inskip,* C. T., Esq., Merchant ...	1870
	Ishore Pershaud Narain Singh, Bahadoor, Maharajah of Benares ...	1854

J.

	Jackson, W. G., Esq., c. s., Mirzapore ...	1876
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	Jefferson, W. E. S., Esq., Calcutta ...	1875
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	Jenkinson,* E. G., Esq., c. s. ...	1874
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	Johnson, H. Luttmann, Esq., Civil Service, Sylhet ...	1873
	Johnstone, Lieut.-Col. J., Political-Agent, Munnee- pore ...	1871
	Joykissen Mookerjee, Baboo, Zemindar, Ootterpara ...	1852
	Juggut Singh Koer, Tajpore, <i>via</i> Bijnour ...	1874
255	Juggut Jung Bahadoor, Rana, Nepaul ...	1878
	Juggut Sing, Coomar, Kashipore. N.-W. P. ...	1879

K.

	KALEE KISSEN TAGORE, Baboo, Calcutta ...	1866
	Kali Prosunno Ghose, Baboo, Calcutta ...	1877
	Keith,* G. E., Esq., Merchant ...	1880
260	Kemp, Geo. Lucas, Esq., F. R. c. s., Calcutta ...	1871
	Ker Andrew, Esq., Merchant, Calcutta ...	1880
	Kidd, Dr. H. A., Civil Surgeon, Mundla ...	1871
	Kilby, W., Esq., District Supdt. of Police, Jessore ...	1875
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265	King, Dr. Geo., Supdt., Royal Botanical Garden, Cal- cutta ...	1872
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	Kishen Chunder Bhunge, Maharajah of Mohur bhunge, <i>via</i> Balasore ...	1874

K.—(Continued.)

		Admitted
	Kissore Lal Gossain, Baboo, Serampore ...	1880
	Knox, G. E., Esq., c. s., Allahabad ...	1875
270	Knyvett,* Major W. L. N. ...	1864
	Koek, Edwin, Esq., Advocate, Supreme Court, Singapore ...	1890
	Krishnadhun Ghose, Dr., Civil Surgeon, Rungpore...	1874

L.

	LANDALE, D. G., Esq., Merchant, Calcutta ...	1880
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275	Lawrence, Capt. H., Depy. Comm., Sirsa, Punjab...	1877
	Lazarus, F. A., Esq., Calcutta ...	1874
	Lees, Col. W. M., Under-Secretary, Govt. of India, Military Dept., Calcutta ...	1871
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	Leitch, Henry Joseph, Esq., Broker, Calcutta ...	1872
280	Lennox, H. M., Esq., Hyah, Nowgong, Assam ...	1880
	Leonard, T. T., Esq., Bangalore ...	1879
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	Liston, Major J., Deputy Commissioner, Lalitpore...	1880
	Lloyd, M., Esq., Indigo Planter, Shapore Oondee, Tirhoot ...	1863
285	Lutchmeeput Sing, Roy, Bahadoor, Banker, Calcutta	1864
	Luchmessur Sing, Bahadoor, Maharajah, Durbungah, Tirhoot ...	1861
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	Lynch, Dr. Sydney, Calcutta ...	1872
	Lyon, Geo. Kennett, Esq., c. s., Nattore ...	1879

M.

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295	Macdonald, James, Esq., c. E., Allyghur ...	1804
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	Mackenzie, W. S., Esq., Jutwanpore Somastipore, Tirhoot ...	1879
	Mackenzie, W. Esq., Itmasnugger, Somastipore, Tirhoot ...	1880
	Mackillican, J., Esq., Merchant, Calcutta ...	1865
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M.—(Continued.)

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	Mackinnon, John, Esq., Merchant, Calcutta ...	1875
	Mackintosh, A., Esq., Dooria Factory, Tirhoot ...	1879
	MacLachlan, J. E., Esq., Merchant, Calcutta ...	1861
	Maclean, Hon'ble A. T., Civil Service, Calcutta ...	1858
305	Macnamara, J. A., Esq., C. E., Dist. Engineer, Shahabad	1877
	Macpherson,* W., Esq., Civil Service ...	1861
	Maddock, H. R., Esq., Tea Planter, Chittagong ...	1877
	Maharajah of Betteah, Tirhoot ...	1870
	Maharajah of Cooch Behar ...	1864
310	Maharajah (Coomar) of Vizianagram ...	1879
	Mahony, H. C., Esq., Parbutia Factly., Jorehaut, Assam ...	1879
	Manager, Amluckee Tea Company, Assam ...	1877
	Manager, Arcuttipore Tea Co., Cachar ...	1879
	Manager, Awah Estate, Awahgurrh, Agra District ...	1879
315	Manager, Balasun Tea Co., Darjeeling ...	1875
	Manager, Bengal Tea Company, Cachar ...	1867
	Manager, Bishnath Tea Co., Assam ...	1875
	Manager, Boreilli Tea Company, Assam ...	1873
	Manager, Brahmapootra Tea Co., Assam ...	1875
320	Manager, Burramsai Garden, Sylhet ...	1876
	Manager, Boroomcheria Tea Garden, Cachar ...	1876
	Manager, Central Cachar Tea Co. ...	1875
	Manager, Central Terai Tea Co., Darjeeling ...	1875
	Manager, Chenga Tea Association, Darjeeling ...	1875
325	Manager, Chincorie Tea Co., Cachar ...	1875
	Manager, Chumta Tea Association, Darjeeling ...	1875
	Manager, Chunderpore Tea Garden, Assam ...	1875
	Manager, Chundypore Tea Company, Cachar ...	1862
	Manager, Cutlee Cherra Garden, Cachar ...	1865
330	Manager, Dahingepore Factory, Assam ...	1865
	Manager, Darjeeling Tea and Cinchona Association, Darjeeling ...	1879
	Manager, Dooras Tea Company, Julpigoree ...	1879
	Manager, Durrung Tea Company, Assam ...	1877
	Manager of Dewkonall Estate, Cuttack ...	1871
335	Manager, East India Tea Company, Assam ...	1865
	Manager, East India Tea Company, Cachar ...	1866
	Manager, Elambazar Indigo Concern, Bhulpore ...	1877
	Manager, Gellhutting Tea Estate, Assam ...	1877
	Manager, Giell Tea Co., Darjeeling ...	1875
340	Manager, Goomrah Factory, Tirhoot ...	1865
	Manager, Government Garden, Fyzabad, Oudh ...	1871
	Manager, Government Garden, Gondah, Oudh ...	1875
	Manager, Greenwood Tea Garden, Assam ...	1875

M.—(Continued.)

		<i>Admitted.</i>
	Manager, Halmara Tea Estate, Assam ...	1870
345	Manager, Hoelmaree Tea Co., Assam ...	1875
	Manager, Hoolungurree Tea Co., Assam ...	1878
	Manager, Jokie (Assam) Tea Co., Assam ...	1875
	Manager, Julnacheria Tea Garden, Cachar ...	1875
	Manager, Kaliabar Tea Estate, Assam ...	1876
350	Manager, Kallacheria Tea Company, Cachar ...	1862
	Manager, Kallian Tea Garden, Cachar ...	1874
	Manager, Kamptee Gwallie Tea Estate, Debrooghur ...	1875
	Manager, Kanchunpore Tea Company, Cachar ...	1863
	Manager, Kassomaree Tea Garden, Assam ...	1875
355	Manager, Kobira Tea Estate, Mungledye, Assam ...	1877
	Manager, Koeyah Factory, Cachar ...	1865
	Manager, Koomtar Tea Garden, Assam ...	1869
	Manager, Lalla Mookh Tea Garden, Cachar ...	1875
	Manager, Lallacheria Garden, Cachar ...	1879
360	Manager, Luckimpore Tea Co., Assam ...	1875
	Manager, Luckwah Tea Garden, Assam ...	1875
	Manager, Majugram Tea Co., Cachar ...	1875
	Manager, Majulghur Tea Estate, Assam ...	1875
	Manager, Mandakatta Tea Estate, Assam ...	1875
365	Manager, Monacheria Tea Garden, Cachar ...	1875
	Manager, Moran Tea Co., Seebesangor, Assam ...	1875
	Manager, Margaret Hope Tea plantation, Darjeeling ...	1876
	Manager, Massempore Tea Garden, Cachar ...	1875
	Manager, Mettegurrah Tea Concern, Darjeeling ...	1877
370	Manager, Mesia Jan Tea Estate, Debrooghur ...	1875
	Manager, Munguldye Tea Co., Assam ...	1875
	Manager, Muttuk Tea Co., Assam ...	1878
	Manager, Narainpore Garden, Cachar ...	1865
	Manager, Noakacharee Tea Company, Assam ...	1865
375	Manager, Noobaree Tea Estate, Assam ...	1878
	Manager, Nuddea Ward's Estate, Kishnaghur ...	1875
	Manager, Pattareah Tea Co., Sylhet ...	1875
	Manager, Phoenix Tea Co., Cachar ...	1878
	Manager, Piakpara Estate, Piakpara, near Calcutta ...	1879
380	Manager, Punkabaree Tea Co., Punkabaree ...	1878
	Manager, Rampore Tea Garden, Cachar ...	1880
	Manager, Roopacheria Tea Garden, Cachar ...	1875
	Manager, Scottish Assam Tea Co., Assam ...	1875
	Manager, Selong Tea Estate, Shillong ...	1867
385	Manager, Silcoorie Tea Garden, Cachar ...	1875
	Manager, Singtoom Tea Garden, Darjeeling ...	1880
	Manager, Singbulli and Nurmah Tea Co., Ltd., Darjeeling ...	1875

M.—(Continued.)

		Admitted.
	Manager, Singell Tea Company, Darjeeling ...	1874
	Manager, Sissobari Garden, Julpigoree ...	1877
390	Manager, Sonai Tea Co., Cachar ...	1877
	Manager, Springside Tea Garden, Kurseong ...	1875
	Manager, Tarrapore Tea Co., Bentall Div. Cachar ...	1880
	Manager, Tarrapore Tea Co., Lallong Div. Cachar ...	1865
	Manager, Tarrapore Tea Co., Tarrapore Div. Cachar ...	1871
395	Manager, Teendarea Tea Company, Darjeeling ...	1874
	Manager, Teesta Valley Tea Association, Darjeeling ...	1875
	Manager, Terihannah Tea Plantation, Darjeeling ...	1876
	Manager, Tingri Tea Estate, Assam ...	1875
	Manager, Tukvar Tea Co., Darjeeling ...	1878
400	Masters, C. C. Esq., Barrister-at-Law, Bankipore ...	1878
	Manook, Dr. S. J., Civil Surgeon, Chyebassa ...	1866
	Martin, John, Esq., Calcutta ...	1874
	McFarlane, A. C., Esq., Merchant, Calcutta ...	1870
	McIntosh, A. R., Esq., Merchant, Calcutta ...	1872
405	Mess Secretary, 42nd Assam Light Infantry, Shillong ...	1877
	Mess Secretary, 44th N. I., Shillong ...	1878
	Meugens, J. G., Esq., Merchant, Calcutta ...	1865
	Mewburn, G. F., Esq., Merchant, Calcutta ...	1874
	Meyer, H., Esq., Kootahi Factory, <i>viâ</i> Baraitech, Goruckpore ...	1879
410	Michea,* P., Esq. ...	1875
	Middleton, L. G., Esq., Proprietor, Mahelon Tea Estate, Ranchee ...	1880
	Miller, Col. F. J., Umritsur ...	1869
	Minchin, F. J. V., Esq., Aska, Ganjam ...	1862
	Mitchell, R. W. S., Esq., Emigration Agent for Tri- nidad, 9, Garden Reach ...	1875
415	Mohendrolall Khan, Koomar, Narajole, Midnapore... ..	1871
	Mohis Chunder Chowdry, Baboo, Pleader, High Court, Calcutta ...	1880
	Morison, Harry, Esq., Managing Proprietor, Kolea- panie Tea Estate, Jorehaut, Assam ...	1880
	Morriss, E., Esq., Manager, Hong-Kong and Shanghai Banking Corporation, Calcutta ...	1874
	Mosely, T. H., Esq., Merchant, Calcutta ...	1862
420	Mullen, Dr. T. French, Residency Asst. Surgeon, Ulwar, Rajpootana ...	1871
	Murray, J. C., Esq., Calcutta ...	1879
	Murray James, Esq., Calcutta ...	1880

N.

NARAYAN RAO, Maharajah of Dewass, Indore ...	1874
Nassiruddeen Ahmed, Moulvi, Behar ...	1876

N.—(Continued.)

Admitted.

425	Narendra Narain Roy, Baboo, Jemooah Khandi, Moorshedabad ...	1879
	Narsing Row, Zemindar, Vizagapatam ...	1879
	Neish, F. D., Esq., Ramoo Tea Estate, Chittagong...	1879
	Newson, W. H., Esq., Merchant, Calcutta ...	1876
	Newton, E., Esq., Pleader, Allahabad ...	1879
430	Nickels, C., Esq., Indigo Planter, Pussewa Factory, Jounpore ...	1866
	Nilladhur Sing Deo Bahadoor, Feudatory Chief of Killa, Sonopore <i>vid</i> Sumbulpore ...	1874
	Nobin Chand Bural Baboo, Solicitor, Calcutta ...	1874
	Nogendra Nath Mullick, Baboo, Zemindar, Andool ...	1877
	Nolan, Phillip, Esq., Civil Service, Arrah ...	1873
435	Noor Khan, Huzrut, Minister of Jowrah ...	1871
	North, W. M., Esq., Bogracote Tea Estate, Silligoree ...	1879
	Nottobur Sing, Rajah, Chowdry-bazar, Cuttack ...	1879
	Nundlall Bose, Baboo, Zemindar, Calcutta ...	1875

O.

	ORROYCHURN GORU, Baboo, Merchant, Calcutta ...	1856
440	Odling, C. W., Esq., c. s., Arrah ...	1871
	O'Donoghue, C. R., Esq., Pattabong Tea Estate, Darjeeling ...	1878
	O'Keefe, J. W., Esq., Merchant, Calcutta ...	1871
	Oldfield, R. C., Hon'ble, c. s., Allahabad ...	1875
	Oldham, W. B., Esq., c. s. Nya Durnka ...	1880
445	Oldham,* Wilton, Esq., L. L. D., Civil Service ...	1867
	Omesh Chunder Dutt, Esq., Calcutta ...	1874
	Orr, Major Alexander P., Roy Bareilly, Oudh ...	1868
	Osborne, Col. Willoughby, F. R. G. S., F. G. S., Morar ...	1862
	Osborne,* Lt.-Col. J. H. Willoughby ...	1870

P.

450	PARCELL, W. G., Esq., Dehing Tea Co., Assam ...	1877
	Peal, S. E., Esq., Tea Planter, Sapakatee, Seeb-saugor, Assam ...	1867
	Peel,* Fredk., Esq., Merchant ...	1871
	Peppè,* T. F., Esq. ...	1868
	Peppè, W., Esq., Birdpore, Gorruckpore ...	1875
455	Perkins, Dr. R. H., Jabulpore ...	1880
	Perrin, Monsr. J., Silk Filatures, Berhampore ...	1859
	Phillips, J., Esq., Manager, Government Farm, Allahabad ...	1875
	Phipps, S. U., Esq., Calcutta ...	1874
	Piggot, William, Esq., Broker, Calcutta ...	1864

P.—(Continued.)

Admitted.

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	Pinney,* G. F., Esq. ...	1871
	Pirie, A. H., Esq., Canning College, Lucknow ...	1879
	Political Agent for Supdt., Rajkumar College, Bunderkund ...	1876
	Porter, G. E., Esq., c. s., Judge, Gya ...	1880
465	Pott,* A. C., Esq., Merchant ...	1878
	Prannath Pundit, Baboo, Bhowanipore... ..	1877
	Pratapa Chundra Ghosa, Baboo, Calcutta ...	1869
	Pratt, H. Esq., Calcutta ...	1880
	Prentis, Dr. C., Gorruckpore ...	1878
470	Preo Nauth Sett, Baboo, Calcutta ...	1876
	Pringle, R. B., Esq., Badalipur Tea Garden, Assam... ..	1870
	Prinsep, the Hon'ble H. T., Calcutta ...	1879
	Prosonno Coomar Banerjee, Baboo, Calcutta ...	1871
	Purnanund Borooah, Baboo, Extra Assistant Commissioner, Debrooghur ...	1880
475	Pyne, R., Esq., Purneah ...	1867

Q.

QUINTON, J. W., Esq., Civil Service, Jhansi ...	1865
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R.

	Rajendro Narayan Roy, Rajah, Joydebpore <i>via</i> Dacca ...	1880
	Ramanymohun Chowdry, Rai Bahadoor, Zemindar, Rungpore ...	1861
	Ram Rungun Chuckerbutty, Rajah Bahadoor, Hetahpore ...	1879
480	Rampini, B. F., Esq., c. s., Dacca ...	1875
	Ramsay, Herbert, Esq., Tea Planter, Kurseong ...	1878
	Ravenshaw, T. E., Esq., Civil Service, Chinsurah ...	1865
	Rayson, J. Esq., Manager, Bangpara Tea Garden, Debrooghur ...	1877
	Reed,* F. T., Esq. ...	1878
485	Reid, J. R., Esq., c. s., Bareilly ...	1866
	Reilly, Herbert, Esq., Depy. Magistrate, Maldah ...	1872
	Richards,* Vincent, Dr. ...	1879
	Ritchie,† D. W., Esq., Offg. District Supdt. of Police ...	1871
	Roberts, C., Esq., Kurseong, Darjeeling ...	1878
490	Robinson, S. H., Esq., Merchant, Calcutta ...	1854
	Romesh Chunder Mittra, the Hon'ble, Calcutta ...	1874
	Rose, R., Esq., Inspector Postal Department, Dacca ...	1877
	Rowett, R., Esq., Merchant, Rangoon ...	1877

R.—(Continued.)

		<i>Admitted.</i>
	Ruddock, E. H., Esq., B. C. S., Jessore ...	1868
495	Runglall Sing, Baboo, Bhangulpore ...	1876
	Rushton, H. P., Esq., Merchant, Calcutta ...	1879
	Russell,* T. M., Esq., Merchant ...	1868
	Ryves, Chas., Esq., Deanstone Tea Estate, Urngola, Ceylon	1880

S.

	SAGORE DUTT, Baboo, Merchant, Calcutta ...	1855
500	Samachurn Law, Baboo, Merchant, Calcutta ...	1850
	Samanand De, Bahadoor, Rai, Balasore ...	1875
	Samuells, W. L., Major, Asst. Commr., Hazareebagh ...	1875
	Sandys, Edwin F., Esq., Chittagong ...	1877
	Scarth, Edward, Esq., Ningri Ting Tea Factory, Assam	1878
505	Sceales, Jaffray O'Brien, Esq., Bancoorah ...	1869
	Secretary, Assam Company, Calcutta ...	1865
	Secretary, Cantonment Public Garden, Agra ...	1865
	Secretary, Cantonment Fund Committee, Morar ...	1878
	Secretary, Local Funds, Raepore ...	1874
510	Secretary, Local Fund Committee, Ferozepore ...	1861
	Secretary, Local Fund, Nimar, Khudwa ...	1873
	Secretary, Local Committee, Betul ...	1874
	Secretary, Municipal Committee, Mirzapore ...	1869
	Secretary, Municipal Committee, Prome ...	1876
515	Secretary Municipality of Man, Ranipore, Jhansi ...	1878
	Secretary, Patna Municipality, Patna ...	1880
	Secretary, Public Garden, Azimghur ...	1871
	Secretary, Public Garden, Jaloun, Oorai ...	1866
	Secretary, Public Garden, Benares ...	1875
520	Secretary, Public Garden, Rungpore ...	1877
	Secretary, Public Garden, Nowgong, Bundelkhand... ..	1877
	Secretary, Queen's Garden, Delhi ...	1873
	Sells,* A., Esq., C. S. ...	1874
	Sheoraj Sing, Rajah, C. S. I., Kasipore, Naineetal ...	1877
525	Sheo Pertab Narain, Baboo, Pleader, Chuprah ...	1879
	Sherlock, J. E., Esq., Calcutta ...	1878
	Sherriff, W., Esq., Jorrodia, Jessore ...	1859
	Shillingford, G. W., Esq., Kolassy Factory, Purneah ...	1867
	Showers, A. C., Esq., Noakacherra, Upper Assam ...	1879
530	Showers, St. Geo. A., Esq., Cinnamara Factory, Jore- haut, Assam	1875
	Shumsheer Jung, Nawab, Hyderabad ...	1878
	Simons, C. J., Esq., Tea Planter, Mahmarra Factory, via Seesaugor, Assam	1863

S.—(Continued.)

Admitted.

	Simson, James, Esq., Civil Service, Allahabad	...	1856
	Skinner, A., Esq., Mussoorie	...	1854
535	Sladen,* J., Esq., c. s.	...	1876
	Smallwood, A. E., Esq., Broker, Calcutta	...	1875
	Smart, J. F., Esq., Manager Balagan Factory, Noa-		
	• kacherra, Assam	...	1880
	Smith,* Dr. H. S., Civil Surgeon	...	1875
	Smith, W. E., Esq., Dickhora Garden, Nowgong,		
	Assam	...	1875
540	Smith, W. Esq., Dorunda Factory, Chota Nagpore...		1872
	Smith, W. M., Esq., Nya Doomka, S. Pergunnahs	...	1878
	Sparks, H. J., Esq., c. s., Rai Bareilly	...	1876
	Spencer, Harrison, Esq., Tea Planter, Darjeeling	...	1874
	Sprenger, A., Esq., Ex.-Engr., Upper Assam Divn.		
	Debrooghur	...	1880
545	Sri Mohun Thakur, Baboo, Berarie, Bhaugulpore	...	1877
	Stalkartt, William, Esq., Merchant, Calcutta, Vice-		
	President	...	1845
	Stalkartt, J., Esq., Hope Town, Darjeeling	...	1863
	Steel, Octavius, Esq., Merchant, Calcutta	...	1874
	Steel, Donald, Esq., Eastern Cachar Tea Company,		
	Cachar	...	1861
550	Stevens, C. C., Esq., Civil Service	...	1875
	Stevens, H. W., Esq., Supdg. Engr., Durbhangah	...	1867
	Stevenson, Geo., Esq., Civil Service, North Luck-		
	impore, Assam	...	1873
	Stewart, R. D., Esq., Julpigoree	...	1878
	Stewart, M. G., Esq., Merchant, Calcutta	...	1880
555	Stokes, Allen, Esq., E. I. Railway, Jamalpore	...	1867
	Stokoe, T. R., Esq., Barrister, Calcutta	...	1878
	Stone,* C. G., Esq.	...	1875
	Strachan, James, Esq., Kurrachee	...	1880
	Stratton, J. P., Esq., Political Agent, Nowgong,		
	Bundelkhund	...	1873
560	Studd, E. J. C., Esq., Dhoolea Factory, Tirhoot		1875
	Sturmer, A. J., Esq., Talooka Rajah, Cheriakote,		
	* P. O., Zumaneah	...	1866
	Sukharam Martund, Esq., Indoro	...	1872
	Sumbhoo Narayana, Rajah Bahadoor, Benares	...	1872
	Superintendent, Govt. Model Farm, Cawnpore	...	1875
565	Superintendent, Rambagh, Umritsur	...	1859
	Superintendent, Taj Garden, Agra	...	1874
	Superintendent, Central Prison, Benares	...	1871
	Superintendent of, Jorehaut Tea Company, Assam	...	1865
	Superintendent Serajung Jute Compy., Serajung..		1868

S.—(Continued.)

Admitted.

570	Superintendent, European Lunatic Asylum, Calcutta, Bhowanipore	...	1878
	Superintendent, Nuddea Jail, Kishnaghur	...	1878
	Superintendent, Botanical Gardens, Saharunpore	...	1878
	Superintendent, Government Horticultural Garden, Lucknow	...	1879
	Surdharee Lal, Baboo, Zemindar, Bhargulpore	...	1874
575	Suraj Deb Narain Sing, Baboo, Balgarh, Tirhoot	...	1879
	Sutherland, Charles J., Esq., Merchant, Calcutta	...	1838
	Sutherland, A. B., Esq., Merchant, Calcutta	...	1870
	Swaine, G., Esq., Ottur Factory, Tirhoot	...	1875
	Swaine, Dr. R. F., Civil Surgeon, Ranchi	...	1880
580	Swan, W. F., Esq., Calcutta	...	1880
	Syed Wilayat Ali Khan, Patna	...	1876

T.

	TAKILE SEDENATH SING, Zemindar of Kerabally	...	1874
	Takeda, Mr. George, Interior Dept., Japan	...	1878
	Tayloe, * J. E., Esq., Merchant	...	1875
585	Taylor, S. H. C., Esq., c. s., Beerbhoom	...	1878
	Taylor, D. W., Esq., Grantee, Ondh	...	1880
	Terveen, W., Esq., Calcutta	...	1877
	Thomas, G., Esq., Zemindar, Monghyr...	...	1875
	Thomas, † J., Esq., Merchant, Calcutta...	...	1867
590	Thompson, H. E., Esq., Supdt., Govt. Telegraphs, Akyab	...	1879
	Thompson, Lt.-Col. W. B., Depy. Commr. Dumoh, C. P.	...	1879
	Thornhill, * E. B., Esq., Civil Service	...	1875
	Thurnburn, E. A., Esq., Calcutta	...	1879
	Toomey, Geo., Esq., Indigo Planter, Contai, Tirhoot	...	1870
595	Tottenham, the Hon'ble L. R., Civil Service, Calcutta	...	1873
	Tresham, W. C., Esq., Baylah Indigo Concern, Benares	...	1879
	Tucker, Robert, Esq., Tea Planter, Seebasangor	...	1867
	Turnbull, R., Esq., Calcutta	...	1878
	Twynam, * Lt.-Col., E. J. L., Executive Officer	...	1856

V.

600	VENAYK Rao, Gunput Kibia Sahaib, Indore	...	1872
	Voss, C. W., Esq., Merchant, Parla-Kimidi, Ganjam	...	1874

W.

	WALKER, William, Esq., Tea Planter, Seebasangor, Upper Assam	...	1870
	Wallace, Adolphus, Esq., Rungajau Factory, Golaghaut, Assam	...	1866

W.—(Continued.)

		Admitted.
	Wallace, G., Esq., Doria Factory, Golaghaut, Assam	1875
605	Wallace, Capt. W. A. J., R. N., Saidpore	1880
	Walton, T., Esq., Julpigoree	1878
	Ward,* W. E., Esq., Civil Service	1873
	Ward, G. E., Esq., c. s., Jounpore	1878
	Waterfield,* William, Esq., Civil Service	1870
610	Watt,* George, Dr., Educational Service	1875
	Way, Major G. A., Depy. Asst. Adj. Genl. Jubbulpore	1879
	Webb, A. B. L., Esq., Manager, Lloyd's Bank, Darjeeling	1879
	Webster, Alex. L., Esq., Tea Planter, Nutwanpore, Sylhet	1867
	Webster, R., Esq., Serajgunge	1879
615	West, R. Barton, Esq., Calcutta	1876
	Westfield, W. F., Esq., Calcutta	1876
	White,* H. F., Esq., Ex-Engineer	1875
	White, Phillips, Esq., Depy. Commr. Jaloun	1880
	Whitney, F., Esq., Merchant, Calcutta	1875
620	Whitty, Irwin, J., Esq., Civil Engineer, Kurseong	1867
	Wilcox, Frederick, Esq., Bengal Police, Midnapore	1876
	Wilkinson, C. J., Esq., <i>Barrister-at-Law</i> , Rangoon	1870
	Wilkinson, Capt. C. J., Supdt. P. & O. Company, Calcutta	1878
	Williamson,* Capt. W. J., Inspector-Genl. of Police	1867
625	Williamson,* W. P., Esq.	1877
	Wilson,* H. F., Esq.	1870
	Wilson, the Hon'ble Mr. Justice, High Court, Calcutta	1878
	Wilson, A., Esq., Merchant, Calcutta	1879
	Wintle, Lt.-Col., H. R., Commanding at Futtehgurh	1880
630	Wood, E. P., Esq., <i>Barrister-at-Law</i> , Calcutta	1879
	Woodman, J. V., Esq., <i>Barrister-at-Law</i> , Calcutta	1875
	Wood-Mason, J., Esq., Asst. Curator, India Museum, Calcutta	1877
	Woosnam, J. B., Esq., Cinnamara, Jorehaut, Assam	1879
	Worgan,* J. B., Esq., c. s.	1878
635	Worsley, C. F., Esq., c. s., Mozaufferpore, Tirhoot	1879
	Wyer, F., Esq., c. s., Burdwan	1878
	Wyatt, A. W. N., Esq., Bhukwa Factory, Durbhunghah	1878
	Wright, W., Esq., Judge, Small Cause Court, Cuttack	1866

Y.

YULE, Geo. Udney, Esq., Merchant, Calcutta	1879
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Z.

640 ZANDER,* Leo., Esq., Merchant	1872
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Monthly Proceedings of the Society.

Thursday, the 26th February, 1880.

THE HON. LOUIS S. JACKSON, C. I. E., *President, is the Chair.*

The proceedings of the last (December) Meeting were read and confirmed.

The Report from the Council was submitted and adopted.

The election of Officers and Council was next entered on, with the following result :—

President.—The Hon'ble Louis S. Jackson, C. I. E.

Vice-Presidents.—Mr. W. H. Cogswell, Mr. W. Stalkartt, Rajah Suttayanund Ghosal, Bahadoor, and Baboo Peary Chand Mittra.

Secretary.—Mr. A. H. Blechynden.

Council.—Mr. J. W. O'Keefe, Mr. R. Blechynden, Dr. S. Lynch, Mr. W. Waterfield, Baboo Protapa Chunder Ghose, Mr. J. E. MacLachlan, Dr. Geo. King, Dr. J. B. Barry, Mr. S. H. Robinson, Mr. H. J. Leitch, Mr. John Martin, and Mr. G. L. Kemp.

Mr. Kemp's name has been added to the Garden Committee.

The following gentlemen were elected Members :—

Dr. W. H. Gregg, Sheik Atta Hosen, Messrs. James F. Smart and G. E. Keith.

The names of the following gentlemen were submitted for Membership :—

His Highness the Maharajah of Burdwan,—proposed by the President, seconded by Baboo P. C. Mittra.

Dr. R. F. Swaine, Civil Surgeon, Ranchi,—proposed by Capt. L. J. H. Grey, seconded by the Secretary.

H. Pratt, Esq., Manager, Messrs. Osler & Co.,—proposed by the Secretary, seconded by Mr. R. B. West.

L. G. Middleton, Esq., Proprietor, Mahelon Tea Estate, Ranchi,—proposed by Capt. Grey, seconded by the Secretary.

James Hutchison, Esq., M. A., Old Salona, Kobaom, Assam,—proposed by Mr. G. L. Kemp, seconded by Mr. H. J. Leitch.

Edwin Kock, Esq., Advocate, Supreme Court, Singapore,—proposed by the Secretary, seconded by Mr. W. Stalkartt.

Harry Morison, Managing Proprietor, Kolcapanie Tea Estate, Jorehaut,—proposed by the Secretary, seconded by Mr. R. Blechynden.

PRESENTATIONS.

The following presentations were announced :—

1. Further supplies of seeds and plants from the Nicobars. From E. H. Man, Esq.

2. A Geranium plant from Dundee. From A. J. Millner, Esq.
3. Spanish Melon seed of a superior kind. From J. D. Ward, Esq.
4. A bag of imported Mahogany seed. From Dr. Thwaites, Director, Royal Botanic Garden, Ceylon.

5. Three kinds of Cupressus seeds. From J. F. Duthie, Esq., Superintendent, Botanical Garden, Saharunpore.

6. A few seeds from the "indigenous Tea plant," referred to in a previous communication. From G. F. Pinny, Esq., Rungajau, Assam. These have been recognized by Dr. King as the produce of *Camellia drupifera*.

7. Six Brinjalls or Egg plants (*Solanum melongena*), of 3 kinds; 2 of each, of an unusually large size. From H. W. Stevens, Esq.

Mr. Stevens states that these are the produce of acclimatised English seed, imported three years ago, and the largest specimens selected for seed. Less than one acre of ground has yielded 366 maunds of this vegetable at Durbhunga, Tirhoot.

8. A basket of Buist's early sced Tomatos raised from seed distributed by the Society. From Mr. R. B. West.

These have been grown by the side of Vick's criterion and Carter's Green-gage, and have been found superior in every respect.

9. A small plant, in flower of "Geranium, Cannell's New Life." From Mr. West.

Mr. West exhibits this "not so much for the striking novelty of its flower, as for the fact that this plant, with eleven other Geraniums, arrived here only six weeks since from England by overland parcel post, ten out of which are now alive and growing well. They were despatched at end of November when the plants were nearly in a dormant state, all the stems were carefully bound with moss, and the plants packed with the same."

Hyacinths.—Mr. John Martin exhibited two plants in flower—blue and white—"Grand Lilas" and "Mont Blanc."

Mr. F. A. Lazarus also shewed two in flower—"Grand Lilas" and "Charles Dickens;" and one came from the Society's Garden (red flower) named "Lord Derby."

The Rajah Suttayanund Ghosal placed on the table seeds of a creeper known as "Shah Possum." Baboo Peary Chand Mittra observed that this seed, in a powdered state, is said to have cured leprosy. He had ascertained this from Pundit Eshwan Chunderg Vidyasagar and Professor Rajkrishna Banerjee, who had, moreover, told him that the number of applications for this seed was so great that they could not meet the demand. These gentlemen had promised him a statement which, when received, would be submitted to the Society.

HORTI.-FLORICULTURAL EXHIBITIONS.

The following reports of the Judges on the show of Vegetables and Fruits, held in the Town Hall on the 29th January, and of Flowers held in the Society's Garden on the 16th February, were submitted:—

HORTICULTURAL—*Judges* :—Messrs. W. H. Cogswell, W. Stalkartt, S. H. Robinson, and Baboo Peary Chand Mittra.

The show was, perhaps, the largest, or one of the largest, held during the last 40 years, or since such exhibitions were commenced. About 80 market gardeners, besides a few private gardeners, were in attendance; a few bringing as many as 20 baskets, others 16, and others 12, some only 1 or 2; but the average was about 10, equal to 800 baskets in all, containing 24 or 25 kinds of European vegetables, a few Native vegetables, and a fair collection of fruits. The tables in four lines arranged for their reception, two baskets in each row, occupied some 600 feet and extended nearly the whole length of the Hall. Notwithstanding this accommodation, it was found necessary to place many baskets—about 200 feet in length—on the floor. Had so large a display been anticipated, additional tables would have been provided.

Among the European vegetables—Cauliflowers, Cabbages, Khol-Kole, Turnips, Beet, Carrots and Onions were most largely displayed, and among them were some very well grown specimens. The Celery was fair, and Peas also. There were several baskets of Artichokes and Asparagus, though too early in the season for a fair display. Among the Native vegetables, there were several baskets of well grown specimens of Beans, Chillies, pot herbs, and Indian Corn. In the Fruit Department—Balls, Limes, Citrons, Sapotas, and long plums were conspicuous; there were also Pummelows, Guavas, Pineapples, and Custard Apples, though out of season.

A list of the prizes, amounting to Rs. 281, is hereto annexed.

The thanks of the Society are due to the Chairman of the Municipality for the free use of the basement story of the Town Hall and tables belonging thereto. Also to the Manager, Great Eastern Hotel Co., for the free use of tables.

FLORICULTURAL—*Judges* :—Dr. G. King, Messrs. W. Waterfield, G. L. Kemp, and W. Pigott.

The collection of plants rather exceeded that at last year's show. The competition was about the same. The produce of some twenty gardens was placed under the tents. The display of handsome foliage plants, such as *Dracænas*, *Begonias*, *Palms*, *Crotons*, &c., was tolerably good. The assortment of *Roses* in pots was limited, it being rather late in the season; but the boxes of cut specimens were excellent, especially those submitted by Col. May from Chupra, and the Belvedere Garden. The collection of annuals was considerably in excess of last year (when the show was held a fortnight earlier) consisting, among others, of *Asters*, *Pinks*, *Pansies*, *Phloxes*, *Snapdragon*, *Tropæolum*, *Portulacas*, and *Petunias*. The *Asters*, *Pinks*, and *Heartsease* were especially good. *Verbenas*, also, were well represented.

Among novelties were plants of *Azaleas*, *Fuchsias*, *Eucalyptus citriodora*, and a Tree Fern. There were more specimens of *Camellias* than heretofore.

Proceedings of the Society.

For orchids in flower the season was too early; but there were a few good specimens from Baboo Prosonno Coomar Bannerjee's garden, and a fine example of *Vanda gigantea* from the garden of Rajah Suttanundo Ghosal Bahadoor.

The Royal Botanic Garden contributed some fine grown plants to add to the interest of the show. These were not in competition for prizes. Among those sent from the Botanical Garden may be mentioned:—*Phalaenopsis amabilis*, *Saccolabium Harrisonianum*, *Cypripedium venustum*; several new introductions from Jâva, Mauritius and elsewhere, such as *Pinanga maculata*, *Areca crinita*, a new variegated *Tradescantia*, a number of Cacti, not previously exhibited in Calcutta, and some pretty new ferns from South America.

The Belvedere Garden collections were the largest, and many prizes were awarded for them. The cut specimens of Roses, as already remarked, were excellent. Crotons, Dracænas, Palms and Begonias were most prominent; also a large collection of annuals.

The Eden Garden likewise contributed largely and gained several prizes. They shewed especially in Crotons, Palms, Dracænas, Begonias, and annuals; also Cactus plants.

The President's prizes, for rare and well grown plants not included in the general list, were fully competed for by Mr. E. G. Keith for a Tree Fern, for Fuchsias and *Eucalyptus citriodora*; by Mr. H. C. Rostan, for Azaleas; by Baboo Prosonno Coomar Bannerjee, for a collection of Orchids; by Rajah Suttanundo Ghosal, for an excellent example of *Vanda gigantea*, and by Mr. D. Low, for a collection of 12 Ferns.

Mr. Low gained the first prize for the best collection (12) of Crotons, and Moulvee Ahmed for the second best. Baboo S. P. Chatterjee for the best collection of Crotons of recent introduction, and the Belvedere Garden for the second best. Mr. Low also exhibited a glazed stand containing a fine example of *Adiantum Farleyense*, and a stand covered with *Adiantum Capellus Veneris* and other Ferns and plants, 46 in all, to which prizes were awarded.

From Mr. Pigott's garden came seven new varieties of Coleus, fine specimens of *Dracæna Gooldieana*, *Davidsonia pruriens* and *Macrozamia plumosa*, a new Cycadaceous plant. These gained the first prize for new and rare plants.

Mr. R. B. West gained the first prize for the best collection of Dracænas of recent introduction.

There was a large attendance of visitors, probably one thousand, including children. The show was opened at 4 and lasted till dusk.

The best thanks of the Society are due to Col. Rogers, V. C., and Officers of H. M.'s 90th Regiment, for the attendance of their fine band.

The sum of Rs. 300 was awarded in prizes, of which a list in detail is annexed.

The Judges would suggest that a clause be introduced in the conditions, rendering it imperative on exhibitors to allow their plants to be properly arranged by

Proceedings of the Society.

the Society's Gardener, that is to say, each kind to be separately staged together, so as in future to save the Judges unnecessary trouble in awarding prizes.

FIBRE FROM KUMAON.

The Secretary drew the attention of Members to a communication in the proceedings of the last Meeting from Mr. J. G. Bellairs of Chowkoora Tea Factory, Almora, Kumaon, respecting sample of a fibre procured from plants growing on his estate and of cloth made therefrom; also to the report of the Fibre Committee thereon. He had since received a specimen of the plant from Mr. Bellairs which Dr. King has recognized as *Maoutia puza*, Wedd. = *Bakheria frutescens*, Ham. and Don. The Secretary further called attention to the fact that so long ago as 1847, Dr. A. Campbell, then Superintendent of Darjeeling, brought this fibre to the notice of the Society and gave a short description of it, its habitat, when used, how prepared, &c. A favorable report on the fibre was made by the Committee who valued it at Rs. 12 per maund, and were of opinion that "if properly prepared and dressed the *wool* is capable of being converted into fibres much finer than either sail cloth or sewing twine." (All these particulars will be found in the Journal Vol. VI., old series.)

COMMUNICATIONS ON VARIOUS SUBJECTS.

1. From Capt. J. F. Pogson, Koteghur, on the subject of *Sorghum saccharatum*, as a new food grain for the Hill people.
 2. From H. James Rainey, Esq., Khoolna,—a paper on the Field Rat of Bengal.
 3. From T. M. Francis, Esq., particulars of trials made of upside-down cuttings of plants.
 4. From Capt. Pogson, details regarding the propagation of the Singhara nut, in reply to enquiries, by Mr. L. Bernays of Queensland.
- The above four papers were transferred for publication in the Journal.
5. From E. Buck, Esq., on the subject of certain of the S. African *Euphorbiaceæ*, whose juice is stated to be a preservative for iron. (See Col. Lee's letter read at last Meeting.)

The Secretary mentioned he had, previously to the receipt of Mr. Buck's letter, addressed the Superintendent of the Cape of Good Hope Botanic Garden, on the subject.

6. From the same, in respect to seed of the Argan tree of Morocco. Seed daily expected from the Society's seedsmen at Erfurt, Messrs. Haage and Schmidt.

7. From Messrs. Williamson Magor & Co., in respect to a certain communication from Mr. Grote regarding Tea pests on the Munguldye Tea Company's Estate, to which the Manager's particular attention is requested.

In connection with the above, the Secretary submitted further correspondence on the coffee leaf disease, with which he had been favoured by Dr. Thwaites,

he Director Royal Botanic Garden, Ceylon, which shows a great difference of opinion in respect to the proposed sulphur remedy.

8. From the Hon'ble H. T. Prinsep, Chairman, Economic Museum, returning thanks for the specimen of first manufacture of Andaman raised Tea.

9. From the Director Smithsonian Institution, Washington, returning thanks for copies of this Society's publications.

Thursday, the 25th March, 1880.

W. H. COGSWELL, Esq., V. P. in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members :—

His Highness the Maharajah of Burdwan, Dr. R. F. Swaine, Messrs. H. Pratt, L. G. Middleton, James Hutchinson, Edwin Kock, and Harry Morison.

The names of the following gentlemen were submitted for Membership :—

Major J. Liston, Depy. Commissioner, Lalitpore,—proposed by Mr. J. W. Quinton, seconded by the Secretary.

Lieut. A. Connell, Asst. Engineer, Fyzabad, Oude,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

J. J. Cumming, Esq., Merchant, Kurrachee,—proposed by the Secretary, seconded by Mr. G. L. Kemp.

Philips White, Esq., Depy. Commissioner, Jaloun,—proposed by Mr. J. W. Quinton, seconded by the Secretary.

W. à. Court Beadon, Esq., Supdt. of the Central Jail, Midnapore,—proposed by Mr. W. Cornell, seconded by Mr. F. Wilcox.

Andrew Ker, Esq., (Messrs. King, Hamilton & Co.,) Calcutta,—proposed by Mr. G. L. Kemp, seconded by the Secretary.

Manager of the Rampore Tea Garden, Cachar,—proposed by Mr. H. F. Brown, seconded by Baboo P. C. Mittra.

CONTRIBUTIONS.

1. Suggestions regarding Forest Administration in Ajmere and Merwara. Progress Report for 1878-79 of Forest Administration in Assam ; in the Punjab ; in the N.-W. Provinces and Oudh ; in Ajmere ; in the Central Provinces, and in the Hyderabad Assigned Districts. From Government of India in the Home, Revenue and Agricultural Departments.

2. Report on the Internal Trade of Bengal for 1878-79. Records of the Geological Survey of India, Vol. 12, Part 4. Report on the Administration of Bengal 1878-79. The Wheat production and trade of India. From the Government of Bengal.

3. A descriptive Atlas of the Eucalypts of Australia (4th Decade). By Baron F. Von Mueller. From the Author.

4. Report of Bengal Chamber of Commerce. October 1879. From the

5. The *Indian Forester*, No. 3, Vol. V. From the Editor
6. Journal Asiatic Society of Bengal, Part 1, No. 4, 1879. Proceedings for November and December, 1879. Descriptions of new Indian Lepidopterous Insects (W. S. Atkinson). From the Society.
7. Transactions Asiatic Society of Japan, Vol. 8, Part 1.
8. Journal of the Royal Horticultural Society of London, Vol. 5, Part 9. From the Society.
9. Proceedings of the Agri.-Horticultural Society of Madras, from May to December, 1879. From the Society.
10. A small collection of grass seeds. From the Director Royal Botanic Garden, South Adelaide.
11. Plants and seeds from the Nicobars. From E. H. Man, Esq.
12. Seed of *Alphetquia excelsa* and *Stenocarpus Cunninghamii*. From L. A. Bernays Esq., V. P., Queensland Acclimatisation Society. Mr. Bernays writes—that the former is a good bitter bark, and the latter a very beautiful tree with crimson flowers.
13. Seed of *Eucalyptus globulus* and *Grevillea annulifera*. From Baron F. Von Mueller.

The following is extract of a letter forwarding the above seeds:—

“It affords me much pleasure to send you some *Enc. glob. seeds*, at least sufficient for tests in various places. I have no means of collecting these kinds of seeds on an extensive scale; indeed all kinds of *Eucalyptus* seed ‘en gros’ are now articles of trade by seed merchants. The seed of *E. globulus* has risen in price as gradually the native trees in the forests become extensively felled; it used to be 15 shillings per pound, but cannot now be got for less than 18. But one pound contains seeds enough for a multitude of thousands of plants. If therefore any Member of your Society wants to rear on *an extensive scale*, it could be easily calculated at what price the seeds might be got in the Melbourne market, where I will be happy to procure them and see that they are fresh and correct to name.”

14. A collection of Cucurbitaceous, Maize, and other seeds. From Captain J. F. Pogson. These seeds are available to Members. (Full particulars regarding them will be found in the body of the proceedings.)

GARDEN.

The Head Gardener's Report was read as follows:—

“The weather has been seasonable, though the rough south-west winds have caused rapid evaporation, thus requiring extra labour in watering the plants which we are obliged to keep in pots to be ready at a moment's notice for any orders that may come in. We have re-established the water communication with the west tank so as to free as many hands as possible for potting off young stock, and arranging the same; also to bring all the fruit trees into one section of the garden, such as Mangoes, Lichees, Peaches, Limes, ‘forbidden fruit,’ Anona, Loquat, &c., of all of which we have a very fair stock. Members' orders to the number of 63, besides many supplemental ones, have been executed since

the opening of the year 1880, exclusive of sales to non-Members. Of Palms we have a large stock especially *Caryota* of kinds which when planted out in a garden, are extremely useful, as they grow fast and their foliage is elegant when compared with surrounding shrubs. Of *Araucaria Cunninghamii* we have about 20 fine plants averaging 6 feet in height. During the cold season many Palms and *Araucarias*, &c., were successfully moved to new sites as they were becoming crowded. One corner of the Garden which was originally covered with jungle has been planted out with *Agaves*, *Fourcroyas*, *Euphorbias*, *Cacti*, &c. The large Plant House near the dwelling has been repaired and enlarged, the size now being 110 feet in length by 38 feet in breadth. I however propose that we might have separate houses for *Orchids*, *Ferns*, *Dracenas*, *Crotons*, and miscellaneous plants, so that Members and others would be saved from loss of time in making their selections. Of new *Marantas* and *Crotons* we have a fair stock in hand, also a large stock of *Allamanda* of kinds, extremely showy plants for lawns as they stand the sun well. Six *Plantains* presented by C. Ady, Esq., of Moulmein have been planted out on the north side of the Kitchen Garden. This plot of land I think might be utilized for the trial of vegetables, but must in the first instance be heavily manured as the soil is very poor. We have many *Janipha Manihot* plants in hand. The west tank near the principal entrance should be excavated early this year, as soon as the water gets below zero. Of *Liberian Coffee* we have 140 plants available; the seed sent on the 6th of January, 1880, from Munceerabad (Madras Presidency) has not yet germinated fully. Of *Mahogany* plants we have only 28 left of those sent by W. H. Cogswell, Esq., and 170 of our own sowing. We have only 34 *Avocado Pears* left. The flower beds should next year be distributed more equally around the Garden grounds, where space permits, instead of in one special place near the west gate, which, though introductory, is certainly unsuitable on the north side of the entrance tank, the flower beds having been arranged under the *Mango* trees some years ago. New *Rose* beds will be formed around the central lawn and other positions as opportunities offer. *Caladiums* are being started, preparatory to potting off, they are not therefore available for a short time. *Contributions*.—A large quantity of house-rubbish has been placed at our disposal, from the Collectorate compound, 'Alipore', being closely adjacent to the Garden and will prove extremely useful for repairs of walks. Manure of good quality is being steadily and gradually carted from the Stud Depot, Garden Reach, through the kindness of Major Roberts. *Anæctochilus* sp. (gold veined leaf), presented by O. Wynton, Esq., in company with orchids and other plants, the first named is doing very well, the remainder fairly good. The *Anæctochilus* having been kept in a cool place without any glass protection whatever and being liberally supplied with water, have succeeded very well in the sand and moss into which they have been transferred. We really require a large supply of moss for numerous purposes. Members who are placed in situations suitable for the collection of moss might respond to this

Mr. Gleeson also sends lists of Rôse plants recently received from the Allahabad and Agra Gardens, which have reached in good order. Those from the Lahore Garden have been but partially successful; whilst those from Mr. Bull of London have unfortunately proved a failure. A list of 20 rare plants transferred to the Royal Botanic Garden, Howrah, is also appended. These consist principally of Anthuriums, also Marantas, Cumerias, Alocasias, and Aralias.

The Gardener likewise forwarded a box of cut flowers of Petunias, Philox, and Verbena raised from seed contributed by Messrs. Sutton & Sons, and sown on 8rd December last. These were all much admired.

The Secretary also placed on the table some pots of Philoxes and Asters of superior kinds. Flowers of the latter measured nearly three inches in diameter.

NEW PLOUGH.

A preliminary Report was read from a Sub-Committee of the Council on a new plough manufactured by Mr. W. Martin of Etawah. The Committee state that this plough, made by a common native mistry costing four rupees, and weighing about 12 seers, was tried at the Society's Garden with an ordinary native plough costing two rupees. "The trial lasted about half-an-hour. The bullocks and men employed for the first 15 minutes on Mr. Martin's plough were transferred to the native plough and *vice versa*; but the cattle and men, in both instances, appeared to work with greater ease with the native than with Martin's plough. The trial was only so far determinable, as the men and cattle who worked on the new plough were evidently quite unaccustomed to the extra weight thrown on them by the mould board in the act of inverting the sod. Another great drawback was the dry and hard condition of the land. For this and other reasons, it was agreed to have another trial under fairer auspices on as early a date as possible. It was, however, evident to those present that the plough had considerable merit and did its work well, breaking the soil fairly up with one ploughing. Your Committee are not prepared to add more to this report, the trial being a partial one, and merely preliminary."

Resolved.—That another trial, with such other new ploughs as may be offered, be undertaken at commencement of rainy season.

EXPERIMENTS WITH CATTLE MANURE.

Submitted a Resolution of the Government of Bengal on the subject of trials with Cattle Manure in reference to recent experiments at the Farm at Bangalore, and suggesting that probably trials of a similar nature might be undertaken at certain localities in Bengal; whereupon it was resolved that a Sub-Committee consisting of Drs. Barry and Lynch, Messrs. Cogswell and Stalkartt, be appointed for the purpose of suggesting the best means of furnishing the Government with information on the subject of manures.

KOTEGURH, AND ITS AGRICULTURAL PRODUCTS.

The Secretary next submitted an interesting paper from Captain Pogson, in reference to the various kinds of seeds alluded to under the head of contributions :—

Letters were read—

From Mr. T. R. Fernandez, Superintendent of the Revenue Survey, Bharnagore, reporting the result of his sowings of the Bamia Cotton from seed received from the Society, and sending a small specimen thereof.

From Mr. W. Foley, submitting specimens of tobacco raised in Sylhet, from seed received from the Society and of a fibre and cloth made therefrom, from the "Kaddeema" tree (*Villebrunea appendiculata*?)

Baboo Pertap Chunder Ghosa reports favorably of the tobacco. The fibre possesses great strength.

Further particulars regarding the latter to be supplied by Mr. Foley.

Thursday, the 20th May, 1880.

THE HON'BLE LOUIS B. JACKSON, C. I. E., *President, in the Chair.*

The proceedings of the last (March) Meeting were read and confirmed.

The following gentlemen were elected Members :—

Major J. Liston, Lieut. A. Connell, Messrs. J. J. Cumming, Philips White, W. A. Court Beadon, Andrew Ker, and Manager of the Rampore Tea Garden, Cachar.

The names of the following gentlemen were submitted for Membership :—

Baboo Jodrolaul Mullick,—proposed by Rajah Suttayanund Ghosal Bahadur, seconded by Baboo Peary Chand Mittra.

Baboo Bejoy Kissen Mookerjee,—proposed by Baboo P. C. Mittra, seconded by Rajah S. A. Ghosal.

Henry M. Lennox, Esq., Hyab, Nowgong, Assam,—proposed by the Secretary, seconded by Mr. W. H. Cogswell.

Baboo Kissorelal Gossain, Serampore,—proposed by Rajah S. A. Ghosal, seconded by Baboo P. C. Mittra.

William Oldham, Esq., c. s., Dumka,—proposed by Mr. H. M. Kisch, c. s., seconded by the Secretary.

Baboo Mohis Chunder Chowdry, Pleader, High Court,—proposed by Baboo P. C. Mittra, seconded by Rajah S. A. Ghosal.

Baboo Bholanath Dhur, Merchant, Calcutta,—proposed by Baboo P. C. Mittra, seconded by Rajah S. A. Ghosal.

Rejoined—J. Deveria, Esq., Calcutta, and G. E. Porter, Esq., c. s., Gya.

CONTRIBUTIONS.

1. Records of the Geological Survey of India, Vol. 13, Part 1, and Memoirs of the same, Vol. 17, Part 2. From the Government of Bengal.

2. The Eucalypts of Australia (5th Decade). From the Author, Baron F. Von Müeller.
3. Notes on the introduction of Carolina Rice into India. From the Government of Bengal.
4. The *Indian Forester*. Vol. V., No. 4. From the Editor.
5. Report on the Sydapet Experimental Farm, for year ending 31st March, 1879. From the Manager.
6. Baron Von Müeller's Select Plants, for extra tropical countries. From the Government of India.
7. A collection of seeds and plants, including *Araucaria Cookii* and Crotons of sorts; also seeds of *Gmelina Leichhardtii* and *Tristania conferta*, both good timber trees. From L. A. Bernays, Esq., V. P., Queensland Acclimatisation Society.
8. Seeds of several kinds of Eucalyptus. From Mr. C. F. Creswell of Melbourne.
9. Seeds of *Amherstia nobilis*, teak and "Padouk" (*Pterocarpus dalbergioides*). From C. Ady, Esq.
10. A few seedlings of *Amherstia nobilis*. From R. Rowett, Esq.
11. Tubers of Begonias, Achimenes, and Gesneras. From Dr. T. Beaumont.
12. Plants of *Cyn. odeira fulgida*. From Dr. G. King.
13. Seed of the blood-red Orange of Malta. From Col. W. M. Less.
14. Seeds and plants from the Nicobars. From E. H. Man, Esq.
15. A quantity of American Tobacco seeds of three kinds—White Stem, Orinoco, and Connecticut. From the Department of Agriculture, N.-W. P.

RESIGNATION OF THE PRESIDENT.

Read a letter from the Hon'ble Mr. Justice Jackson, C. I. E., to the Council, intimating his resignation of the office of President of the Society, consequent on his approaching departure from India.

Submitted the following Resolution of the Council:—

"The Council cannot accept the resignation by the Hon'ble Mr. Justice Jackson, C. I. E., of the office of President, without placing on record their warm appreciation of the interest he has taken, and the valuable services he has rendered to the Society in dealing with the various subjects that have been under consideration, since he was unanimously elected in January 1876. The Council regret exceedingly that ill health obliges Mr. Jackson to vacate office, and beg to propose, in recognition of those services, his nomination as an Honorary Member of the Society."

Baboo Peary Chand Mittra, V. P., in proposing the cordial confirmation of the above Resolution spoke to the following effect:—You are well aware, Gentlemen, that we are deeply indebted to Mr. Justice Jackson, our President, for the warm interest he has taken in the affairs of our Society, for the sound

judgment he has brought to bear on the important questions which have come before the Council and the Society for consideration, and for his powerful advocacy and influential aid in improving the financial position of the Society. For these valuable services, Mr. Jackson is certainly entitled to our gratitude, and it is with much regret we now part. In bidding him farewell, let us hope that in returning to his native land, Mr. Jackson may, by the blessing of God, be restored to the enjoyment of health and strength.

Mr. W. H. Cogswell, V. P., said, he had pleasure in supporting the Proposer's views, which were so ably expressed, and which so well coincided with his own opinions and feelings, and, he was sure, those of the Council at large. The resignation of the President, Mr. Justice Jackson, would be a great loss to the Society, and a matter of very considerable regret to all, particularly under the circumstances that failing health necessitated such a step; and he could only hope that Mr. Jackson would be speedily restored to health by the change he was now contemplating.

The Resolution was then put and carried unanimously.

Mr. Jackson replied as follows:—

GENTLEMEN,—I am touched by the kindly terms used in speaking of me by the Proposer and Seconder of this Resolution; the more so, because I have always regarded myself as a mere stop-gap in holding office as your President, being well aware of the serious difficulties under which I labour. I can, at all events, claim the merit of having brought good-will to the aid of any qualities I may possess, and I can most truly say that, while the success of a President's administration must depend largely in the aid afforded by his colleagues in Council, I have had that assistance in the fullest degree, and it is to that assistance that I ascribe any advantage which the Society may have derived from my connection with it.

GENTLEMEN, the interruption of my official connection with the Society breaks one of the linked associations which have so largely entered into my later life in India. I am glad to feel that among the many friends whom I leave behind, I may count the Members of this Council, and it is particularly pleasing that in consequence of your flattering Resolution, the connection between us will not be altogether broken.

GARDEN.

The Head Gardener's Monthly Report was read, of which the following are extracts:—

"The weather during the past two months has been favourable for the Garden generally, alternating showers and sunshine. The work, as usual, in regard to cleaning up the Garden. Preparations are being made for grafting work. Rose layering has been already put in hand; beds are being made around the centre lawn for the reception of roses received from Allahabad, Agra, and Lahore. We have, in the first instance, measured out one acre of land for ex-

perimental work in compliance with the Resolution of the Government of India (Agricultural Department) under date 27th February, 1880, but we shall not be able to carry it out this year in full integrity, the proposal having been made so late. The land (1 acre) having been marked out, it remains to decide what manures can be used, also the most appropriate crops to illustrate the action of the manures. Of the following plants, we have a large stock in hand for distribution in the ensuing rains—*Livistona mauritiana*, *Caryota subulifera*, *Vanilla aromatica*, *Licuala peltata*, *Casuarina muricata*, *Antigonon leptopus*, *Quisqualis Indica*, *Pandanus Mollori*, *Pothos*, *Caladium*," &c. &c.

Mr. Gleeson next refers to several presentations (already alluded to under the head of contributions), including a gift from Mr. C. Brown of some 200 Orchids, and a few Ferns collected at Port Blair; also some Palm seeds from the Royal Botanic Garden, Mauritius, which are valuable, as the seeds invariably germinate, and 50 seeds of *Amherstia nobilis* from Mr. C. Ady, of Moulemein. These have all, unfortunately, failed; the cotyledons seemed to have separated from each other, exposing the delicate embryo at the base, this may account for their non-germination; seeds when sent should, if possible, be packed in some light material, such as a small plantain stalk folded double, a small quantity of brown paper would exclude the direct influence of the dry air. *Clanthus Dampieri* (of which some seeds have been recently received) has been tried several times in the Garden, but have failed to germinate, their success depending apparently more on the soil than the climate. A nice collection of Gesneras, Achimenes, and Begonias have been received from Dr. T. Beaumont of Indore.

EXPERIMENTS WITH MANURES.

A preliminary report was read from the Sub-Committee appointed at last Meeting. The Committee submit a sketch-plan, suggesting certain kinds of manures and certain kind of crops, to be carried out as far as practicable, but preference to be given to natural (farm yard) manures. That one acre of land be set apart for the purpose in the Society's garden; that the manures employed be dried cow-dung, ashes of cow-dung, and cattle box-dung, and that a quarter of an acre be given to each, and one quarter be left unmanured. The test crops to be maize, sun-hemp, jute and bajra. Agreed to.

MODELS OF VEGETABLES PREPARED BY MESSRS. SUTTON OF READING.

The Secretary next drew the attention of the Meeting to the interesting large case of models of Vegetables, presented to the Society, by Messrs. Sutton of Reading, and read the following extract of a letter from that Firm in reference thereto:—

"Mr. Jennings, when he was here, was very interested in our Modelling Room, and in answer to our enquiry, whether he thought a present of a set of English vegetables would be acceptable to your Society, said, he was quite sure such a gift would be much appreciated."

"All these Models are made by our own people on our establishment, from specimens grown in our trial grounds and elsewhere.

"We have only sent a few varieties, which are capable of cultivation in India. We hope by careful attention to the instructions enclosed in the box, it will not be found difficult to place them in the case on arrival."

The case in question (with a glass cover) measuring 7 feet by 3 feet contains some 40 kinds of vegetables, exceedingly well modelled. All reached in excellent condition, without the least breakage, having been so carefully packed. The contents were much admired, and the cordial thanks of the Society were voted to Messrs. Sutton for this handsome and acceptable contribution to the Museum.

MODEL OF A SUGAR-CANE MILL.

The Secretary also drew attention to a contribution to the Museum from Messrs. Thomson and Mylne of Beheea of a Model (half size) of their Sugar-cane Mill. The donors state that "there are now 9,500 of these Mills at work in this and neighbouring districts and other parts of India, including 271 at Bunnoo, Trans-Indus. In the box you will find instructions as to the management of the Mill in English, Oordoo, Hindee, and Bengalee, and also in these languages comparisons shewing the advantages worked out by the Beheea Mill over the several Native Mills."

TURNIPS, RAISED AT RAMCOLLAH.

Mr. W. H. Llewellyn submits several turnips raised from "Sutton's prize Swede," as specimens of the result of a recent trial on his grounds at Ramcollah, Sarun. The quantity realized was 880 maunds per beegah of 3,600 square yards, which is equal to about 40 tons per English acre. The ground these turnips were grown on was manured with "seetee" or indigo refuse. The Secretary, in connection with this experiment, called attention to several trials with turnips, as introduced in Lawson's Agriculturist's Manual, especially to one of the most favorable, namely, a crop of Sweedish turnip, manured with bone-dust, which yielded only 27 tons per acre. The turnips sent down by Mr. Llewellyn are of excellent quality.

DISTRIBUTION OF USEFUL SEEDS.

The Secretary announced the receipt, since the last Meeting, of a supply of seeds of Guango (*Pithecolobium saman*), from the Royal Botanic Garden, Ceylon, of *Catalpa bignonioides* from the Society's seedsman at Philadelphia, and of *Beana (Euchlœna) luxurians* from the Society's garden. These are being widely distributed, and there is still a good supply remaining for applicants. The "Guango" is known as the Rain tree (a good fodder for cattle), and the *Catalpa* as an excellent Timber tree. Mr. J. H. Bridgman of Gornuckpore, acknowledging receipt of the latter, observes: "I think it probable that my

neighbour, Mr. Peppè of Birdpore, would much like some of the seed; and I should be very glad to send some to my friend, Mr. Cooke, of the Civil Service, who has lately been appointed to the management, under the Court of Wards, of the large estate of Awa in the district of Etah. He writes to me that he is applying himself zealously to arboriculture in that estate, and I am sure he would be very glad to have the opportunity of trying whether so valuable a tree as this *Catalpa* is said to be, can be successfully propagated."

Mr. W. G. Jackson, c. s., writing from Mirzapore, remarks—"It may perhaps interest you to know that I sowed the *Reana* last year both in the public gardens in Prome and in my own grounds. The soil was the ordinary soil of the place, and no manuring or irrigation was attempted. The plants all germinated and were transplanted without loss and flourished amazingly; growing seven or eight feet high and seeding freely. My horses ate the plants with avidity. I do not think, however, that the plant is needed in Burmah. There is such an abundance of natural fodder trees that no fodder plants are ever cultivated. I do not ask for any this year, as the Manager of the Kuntil Estate here has already introduced it. The fact that the seeds are not suitable for human consumption, is a very serious defect in native eyes."

COMMUNICATIONS ON VARIOUS SUBJECTS.

1. From Dr. John Macgregor, Superintendent, Central Prisons, Benares, forwarding a Plough for trial.

2. From Mr. W. Crawley, Government Experimental Farm, Cawnpore, sending a Plough for trial.

3. From Messrs. Octavius Steel & Co., sending for identification a few specimens of a destructive chrysalis which has lately appeared in Tea Gardens in Cachar.

4. From Messrs. Begg Dunlop and Co., forwarding specimen of an insect which is damaging the tea bushes in one of their gardens in Cachar.

Mr. Wood-Mason, of the Indian Museum, gives the names of the insect above referred to, but is at present unable to suggest any means of destroying them.

5. From W. Aitchison, Esq., of Dooloo, Cachar, regarding the Carob tree and the Vanilla plant:—

"In the last publication of the Society's Journal, Vol. VI. Part II, New Series, I have read an interesting article on the Carob tree. It seems to be a most valuable as well as a very ornamental tree, and I think it would be well worth the trouble of trying to grow it in this district. I therefore beg leave to request your assistance in procuring some seeds; and, as grafted trees seem to be the most reliable for giving good fruit, if you could also get me some grafted seedlings, I would be very much obliged. I will gladly pay all expenses in connection with procuring and forwarding of the seeds and seedlings.

"It may be of some interest to you to know that the young plant of Vanilla, which I received from you in January, 1877, has thriven well, and is now in flower. As yet there are only two racemes or spikes of flowers showing, but even this much is some satisfaction. I planted this Vanilla in the rains of 1877 against a Jack tree, and it has now run up fully twenty feet high, I have also taken four cuttings from it and had them planted against other Jack trees, which seem to suit the plant very well, although, no doubt, it would grow equally well on several other kinds of trees. Mangoes, I believe, would suit well; but the Jack is the only tree I have conveniently near."

6. From the Moharanee Surnomoyee, of Cossimbazar, presenting a donation of Rs. 100 to the funds of the Society, with the expression of her good-will towards the labors of the Institution.

The cordial thanks of the Society were voted to the Moharanee for her kind consideration.

7. From Mr. C. F. Creswell, of Melbourne, presenting several kinds of Eucalyptus seeds and giving some useful information regarding their quality.

8. From P. de L. Lennox, Esq., Kangra, in allusion to a form of cattle disease prevalent in the Kangra district, and his mode of remedy.

9. From Mr. Warren Sterling, some remarks relative to the foot and mouth disease in cattle, and remedy for the same.

The three last papers were transferred for publication in the Journal.

Thursday, the 25th June, 1880.

W. H. COGSWELL, ESQ., *V. P.*, in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following gentlemen were elected Members:—

Baboo Jodrolaul Mulliek, Bejoy Kissen Mookerjee, Kissorsen Gossain, Mohee Chunder Chowdry, Bholanath Dhur; Messrs. Henry M. Lennox, and William Oldham, c. s.

The names of the following were submitted for Membership:—

Mr. J. G. Macdonald, Calcutta,—proposed by the Secretary, seconded by Mr. G. L. Kemp.

Mr. A. Sprenger, Executive Engineer, Upper Assam Division,—proposed by Mr. F. St. C. Grimwood, seconded by the Secretary.

Rajah Rajendro Narayan Roy, Joydebpore, *vid* Dacca,—proposed by the Secretary, seconded by Baboo P. C. Mittra.

Mr. W. F. Swan, Calcutta,—proposed by the Secretary, seconded by Rajah S. A. Ghosal.

Mr. James Murray, Calcutta,—proposed by Mr. J. Martin, seconded by the Secretary.

Rejoined.—Mr. D. G. Landale, Calcutta.

CONTRIBUTIONS.

1. Memorandum on Materials in India suitable for the manufacture of paper (2 copies). From Government of India.

2. Memoirs of the Geological Survey of India, *Palæontologia Indica*, Series X and XIII. From the Superintendent.

3. A few words on the present state and future prospects of Sericulture in Bengal, by J. Louis. From the Author.

4. Proceedings of the Agricultural and Horticultural Society of Madras for March and April, 1880. From the Society.

5. Proceedings of the Asiatic Society of Bengal for February, March, and April, 1880. From the Society.

6. Report of the Committee of the Bengal Chamber of Commerce, for half year ended 30th April. From the Chamber.

7. Report on the Economic Museum, Calcutta (25 copies). From the Central Committee of Management.

8. Seeds of *Cytisus proliferus* and *Hymenæa Courbaril*. From the Royal Gardens, Kew. The former yields a good fodder; the latter is a fine timber tree, a native of South America, where it grows to an enormous size. A valuable resin, resembling the Gumme of Africa, exudes from the trunk. These seeds are available to Members.

9. A few roots of *Tydas* and some Begonias. From Dr. T. Beaumont.

10. Seeds and plants from the Nicobars. From E. H. Man, Esq.

Letters were read—

From the Secretary Government of Punjab, giving the result of sowings of *Bears luxurians* in that Province.

From Under-Secretary Government of Bengal, enquiring if the Society can find room to provide for the necessary accommodation for models and drawings of agricultural appliances, &c., for the inspection of the public and persons interested.

Resolved; that all available space be granted for this purpose.

From the Secretary Bijnour Agricultural Institute, announcing the formation of the Institute and applying for assistance in the shape of plants, seeds and publications.

Resolved, that this be granted to the best of the Society's ability.

From Lieut.-Col. M. Millett, Mussooree, in reference to the allusion in Gardener's report at last meeting to *Clanthus Dampieri*. Col. Millett states that he succeeded very well a few years ago when at Mohtan in raising this plant "a very hot and dry climate, rain fall then 5 64, very cold winter, grown in pots, one seed in each pot, soil one part best leaf mould, three parts well washed blue river-sand, a few lumps of charcoal for ventilation, water as required, but not excessive, flowers fine and perfect, much admired, seeded freely."

From Col. W. M. Lees offering to obtain plants and seeds for the Society from his Brother, the Governor of Luban. Accepted with best thanks.

From H. A. Firth, Esq., to the same effect in respect to Demerara. Also accepted with best thanks.

From Secretary Smithsonian Institution, Washington, returning thanks for copies of the Society's Journal.

Thursday, the 22nd July, 1880.

W. H. COGSWELL, Esq., V. P., in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following were elected Members:—

Mrs. J. G. Macdonald, Messrs. A. Springer, W. F. Swan, James Murray, and Rajah Rajendro Narayan Roy.

The names of the following were submitted for Membership:—

Secretary, Patna Municipality,—proposed by Mr. R. Bignell, seconded by the Secretary

W. Mackenzie, Esq., Huttowrie, Belaspore, Tirhoot,—proposed by Mr. G. Toomy, seconded by Mr. G. Swaine.

Mrs. A. J. Hughes, Mozufferpore,—proposed by Mr. H. Stanley Collier, seconded by the Secretary.

Newton E. Jennings, Esq., Engineer, Kimedi Estate,—proposed by Mr. W. F. Grahame, seconded by Mr. H. J. Leitch.

Rejoined.—A. J. Farquharson, Esq., Tea Planter, Gowhatti.

CONTRIBUTIONS.

1. Proceedings of the Boston Society of Natural History, Vol. 19, Parts 3 and 4, and Vol. 20, Part 1. Memoirs of Ditto, Vol. 3, Part 1, Nos. 1 and 2. From the Society.

2. Notes on Tea and Coffee Fertilizer, prepared by David Waddie. From the Author.

3. Memoirs of the Geological Survey of India, Vol. 15, Part 2. Records of Ditto, Vol. 18, Part 2. Memoirs of Ditto, *Palaeontologia Indica*. Vol. 1, Part 5. From the Superintendent.

4. Journal of the Asiatic Society of Bengal, Vol. 49, Part 2, No. 1, and Vol. 49, Part 1, No. 1, and extra No. to Part 1 for 1878. From the Society.

5. Plants and seeds from the Nicobars. From E. H. Man, Esq.

6. Seed of the yellow flower variety of the Dhak (*Butea frondosa*.) From J. V. Sturt, Esq., V. P., Municipal Committee of Man, Rampore. Mr. Sturt remarks that it is a rare variety, and very pretty seen in blossom alongside of the common or scarlet variety.

7. Seed of *Milletia ovalifolia*, from Rangoon. From R. Rowett, Esq. This is a handsome tree and supposed to furnish the "Moulmein Rosewood."

8. Seedlings of *Amherstia nobilis* and Plantain shoots from Moulmein. From C. Ady, Esq.

9. A quantity of Mahogany seed. From Dr. G. King.
10. Bulbs of *Eurycea Cunninghamii* and seed of *Acronychia Baureri*. From L. Bernays, Esq., V. P., Acclimatization Society of Queensland.

REPORT ON NEW PLOUGHS.

A second report of a Sub-Committee of the Council (Dr. S. Lynch, Mr. W. H. Cogswell, and Baboo P. C. Mittra) in respect to trial of certain ploughs, was read as follows:—

Your Committee presented their preliminary report at the General Meeting in March last on a plough submitted by Mr. Martin of Etawah, when it was resolved that another trial be given to this and any other ploughs submitted for competition, when the rainy season had fairly set in.

Accordingly, on the 23rd June, your Committee met again at the Society's garden, when the following ploughs were arranged for trial:—

1. A combined plough from Mr. Martin of Etawah, single handle, weighing about 12 seers, selling price Rs. 3 at Etawah, in Calcutta Rs. 4.
2. A plough from Mr. Crawley of the Cawnpore Model Farm, made of wrought iron, weighs 14 seers, said by the maker to plough 6 inches without any pressure whatever being used by the ploughman, the cost of making will not exceed Rs. 5, single handle.
3. A plough from the central prison, Benares, double handle, and no beam, cost Rs. 15.

The land on which the trial was made may be termed grass land. It had never before been prepared for any purpose, the grass was in most parts short and close, nowhere long and jungly. Sufficient rain had fallen to render the ground soft and practicable for ploughing purposes.

The cattle employed were the ordinary village plough bullocks.

With respect to the Benares plough (European in all respects, except in the absence of the beam,) it was found to be beyond the powers of bullocks of the above description owing probably to a defect in the shape, the soil clogged at the shoulder of the mould board, increasing the draught, whilst the soil was not turned over; when it was attempted to increase the depth of the furrow, the heel of the plough was lifted off the ground. This is one of the results of the absence of the beam. Another is that the ploughman's command over the plough during heavy work is lost, owing to the absence of leverage. The body of the plough is a heavy inert mass in the ploughman's hands. The width of the furrow with this plough is about six inches. The depth could not be fairly stated from the trial.

This plough might go through light soil previously worked without any difficulty.

The Cawnpore plough, in the like manner, cutting a furrow of six inches in width by about four inches deep, was heavy in draught, and failed to invert the soil. The mould board was clogged all the time.

The plough from Etawah (Martins) performed its work efficiently. It shewed a light draught well within the power of the little Bengali bullocks; it turned the slice completely over, making a furrow of a depth of three inches, with a width of 4½ inches. This plough, whilst it resembles most nearly the native type in construction and cost, makes close approach to the European plough in the mode in which the work is turned out. But there is the radical fault in this and other ploughs with fixed beams, that at the moment when the work is heaviest, the heel of the plough will be drawn up and the point depressed to such an extent as to tax severely the strength of the ploughman.

Resolved that copies of the above report be sent to the parties interested.

RHEEA FIBRE.

Submitted certain papers on the above, forwarded by the Secretary to the Government of Bengal, with a sample of Rhee fibre referred to therein. Mr. Mackenzie adds: "that the Lieutenant-Governor would be glad if he could be favoured with the opinion of the Society as to the commercial value of the fibre and its suitability to the Indian and home markets.

HINGLI TOBACCO AND ALOE FIBRE.

Submitted certain specimens of the above, obligingly forwarded for the inspection of the Meeting, by Mr. H. H. Locke, Secretary to the Economic Museum, with the following note thereon:—

Here are the samples of—

1. Hingli tobacco,
- 2 & 3. Aloe fibre, combed and uncombed,
4. And matting made from the Aloe fibre,

which you thought your Society would like to see to-morrow.

I subjoin some short notes about these things:—

The Hingli tobacco was received from the Magistrate of Nuddea. It had been exhibited at the Ranaghat Exhibition in January last and was sent to us at the end of April. On the 10th May it was thus reported on by a Calcutta expert:—

'A very good sample of Hingli tobacco. Sweet and well cured, comparatively free from stem, worth in 'Calcutta to-day (10th May)

Rs. 9 to Rs. 9-8 per maund, or say Rupee 1 more than good ordinary Hingli.

'Owing to the weight of stem natural to this quality of tobacco, it is not suited for European markets.'

The Aloe fibre and Matting comes from the Hazaribagh Jail. Dr. Cobb, the Superintendent, writes concerning the Matting that 'it is of very superior quality; is everlasting in wear, and looks well to the last. Is especially suited for passages, or the aisles of churches or public buildings; ship and steamer saloons, &c.'

Its price is Rs. 1-4 a yard. Some excellent samples of lines and twines made from Aloe fibre, were also sent by Mr. Winter, the Jailor of the Hazaribagh Jail, for transmission to the Melbourne Exhibition. I am sorry I cannot send you samples of these, but the specimens I received were too small to admit of portions being retained for permanent deposit in this Museum, and the original samples have been despatched to Melbourne.

SEED POTATOS FROM MELBOURNE.

The Secretary drew attention to ten cases of seed potatoes just received from Melbourne, through the kind intervention of Messrs. Anderson, Wright and Co. These potatoes are in excellent sprouting condition, but having arrived too early in the season for Bengal, it was agreed to distribute them to residents at Darjeeling and other hill stations, and ask them to send down a portion of the produce for trial in the plains in the cold weather.

The best acknowledgments of the Society were tendered to Messrs. Anderson Wright and Co. for their kind assistance.

PROPOSALS FOR THE DESTRUCTION OF THE TEA BUG AND OTHER INSECT PESTS IN ASSAM AND CACHAR.

The Secretary next read a letter from the Under-Secretary Government of India, Home, Revenue and Agriculture Departments, forwarding, as requested, certain papers connected with the above important subjects. The papers consist first of a memorial from certain proprietors and agents of tea properties in Cachar, parts of Assam, and other districts, respecting the serious extent to which the tea industry in India is being injured by blight, caused by an insect known as the tea bug, and requesting the services of certain Government Officers, botanical and entomological, being granted towards an enquiry into the whole subject. Then follow—*secondly*, correspondence between the Governments of India and Bengal and the Trustees of the Indian Museum; and *thirdly*, other communications resulting in the deputation of Mr. Wood-Mason to Assam for the purpose of investigating the injuries caused to tea plants by the tea bug, and the best means of destroying the pest.

In connection with the above, the Secretary drew attention to the great interest the Society had previously taken in this subject. For several years past, it would be in the recollection of most of the Members present, the Society had been receiving communications from the tea districts regarding the great and annually increasing damage caused not only by the tea bug but other insects. In view of these numerous notices, the Council suggested to the Society in 1876 the advisability of taking some steps towards endeavouring to remedy this annually increasing evil. The recommendation, it would be remembered, took the form of endeavouring to engage the services of a practical entomologist to travel over the tea districts of Assam, Cachar, and Darjeeling for two years, to study carefully the character and habit of the various kinds of

blight in their several localities, and so be able, probably, to suggest some remedial measures of a practical nature for modifying, if not entirely eradicating, their ravages. For this purpose it was estimated that a sum of Rs. 15,000 would suffice, which could be easily raised by agents of various gardens agreeing to subscribe Rs. 10 for every hundred acres under cultivation. The amount to each would thus have been trifling, even if the results were not successful. The Society, moreover, engaged to secure the services of a competent person and to publish, in due course, the result of his enquiries, supplementing it with a resumé of the papers already collected and published in their Proceedings and Journal during the past eight years. Notwithstanding the Circulars issued on the subject, combined with personal application, this proposal did not meet with sufficient encouragement to enable the Society to take necessary action. Several agents, largely interested, were quite willing to support the scheme provided all would join. As however many, though apparently well inclined, would not come to any definite understanding, the Society, as intimated in the last annual report, were reluctantly compelled to abandon the scheme.

The Secretary added that he had afforded all the information in his power, in the early part of the year, to the originators of the above recent memorial to the Government of India.

Letters were also read—

From the Secretary, Royal Horticultural Society of London, returning thanks for donation of seeds.

From the Secretary, Bijnore Agricultural Society, offering the cordial thanks of the Committee “for the valuable support the Council of the Agri-Horticultural Society have given them by consenting to supply this Institute with copies of their publications and seeds of field crops free of cost.”

Thursday, the 26th August, 1880.

W. H. COGSWELL, ESQ., *V. P.*, in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following were elected Members :—

Mrs. A. J. Hughes, Messrs. W. Mackenzie, Newton E. Jennings, and the Secretary of the Patna Municipality.

The names of the following were submitted for membership :—

Rai Jaikissen, Honorary Magistrate of Patna,—proposed by Baboo P. C. Mitra, seconded by Mr. S. H. Robinson.

Captain W. A. J. Wallace, *E. E.*, Saidpore,—proposed by Mr. H. J. Leitch, seconded by Mr. R. A. Lyall.

Charles Ryves, Esq., Deanstone Tea Estate, Urugala, Ceylon,—proposed by Mr. J. W. O’Keefe, seconded by Mr. J. E. MacLachlan.

A. B. Holmes, Esq., Blackburn Tea Estate, Debrooghur,—proposed by Mr. W. H. Cogswell, seconded by Mr. W. Stalkartt.

Rejoined—C. T. Castle, Esq., District Superintendent of Police, Budaon, and Lieut.-Col. H. R. Wintle, Commanding at Futtehgurh.

CONTRIBUTIONS.

1. Memoirs of the Geological Survey of India. *Palæontologia Indica*. Ser. XIV. From the Superintendent.
2. Journal of the Bombay Branch of the Royal Asiatic Society, No. 67, Vol. XIV. From the Society.
3. Transactions of the Asiatic Society of Japan, Vol. 8, Part 2. From the Society.
4. *The Indian Forester* for July 1880. From the Editor.
5. Memoirs of the Boston Society of Natural History, Vol. 3 Part 1, No. 3. Proceedings Vol. 20, Parts 2 and 3, and Occasional Papers, Vol. 3. From the Society.
6. A number of Mahogany seedlings. From the Superintendent Royal Botanic Garden, Howrah.
7. Seeds and plants from the Nicobars. From E. H. Man, Esq.
8. Seed of the Wild Vine of California. From John Martin, Esq.
9. A small quantity of acclimatized Pea seed from Bettiah. From C. F. Carleton, Esq.

SEED POTATOS FROM MELBOURNE.

The Secretary intimated that he was unable to carry out fully the resolution of the last Meeting in respect to the potatoes received from Melbourne, in consequence of its being too early in the season for sowing at Darjeeling and other hill stations. He had sent out two or three boxes to other localities with the remote chance of succeeding. Messrs. Anderson, Wright & Co., had again kindly promised their assistance towards obtaining another supply in the cold season.

PLOUGHS.

Submitted a letter from the Secretary in charge of the Experimental Farm at Cawnpore, intimating that the plough reported on at the last Meeting was Mr. Crawley's private plough, and not that employed at the Model Farm.

Submitted also the following letter from Dr. Macgregor, Superintendent of the Benares Central Prison :—

I am in receipt of the report of your Sub-Committee on the Benares Jail Plough, and while grateful to the Committee for the trouble they have taken in the matter, I am unable to accept their verdict as satisfactory for the following reasons :—

(1.) This Plough alone has been used in the Jail Farm for over a year, and during that time over 200 acres of soil has been turned over.

(2.) During the ploughing season there are from three to six in daily use in every kind of soil and with every variety of crop. That the work is efficiently done, no one who sees it can have any doubt about.

(3.) This Plough makes ridges or drills for potatoes, carrots, turnips, cane, cotton, &c. &c., which the native Plough cannot do.

(4.) From the above it is not unreasonable to suppose that to the inexperience of the ploughman employed by your Committee, the failure of this and the Cawnpore ploughs are due. It requires some experience to properly adjust the length of the full rope, if too long, the nose of the share buries itself in the ground. Mr. Martin's plough being on the native system was more easily managed by an inexperienced ploughman. If you remember, I volunteered to send a properly trained ploughman to work it, and if I had done so the plough could not possibly have failed. Here it has long passed the stage of experiment and become part of the routine work of the Farm. If your Committee consent to re-open the trial, I shall send a man at my own expense to work the plough, only stipulating that he should work the bullocks for a day or two as practice before hand, for bullocks require training as well as the ploughman. I am aware of the prestige attaching to the report of your Committee and would do all in my power to place the plough in a more favorable light, because I know what it can do.

Resolved, that as the piece of ground in the Society's Garden on which the experiment was made, is now utilized, and no other piece of ground is available, the Meeting regret that they are unable to re-open the trial.

CROCODILE OIL.

Submitted the following letter from the Secretary of the Eglinton Chemical Company, "Limited," of Glasgow, to the address of Dr. Kany Lal Dey, Bahadoor:—

We observed some time ago some reference in a London newspaper to an examination which you had made of Crocodile Oil, and if we remember rightly, the name of Mr. Purcell of Agra was referred to in the same communication.

As we are going into a new process for manufacturing leather, in which process such an oil would be invaluable to us, we shall be obliged, if you will kindly say, from whom we can procure a sample of it, and at what sort of price it could be supplied. If, at the same time, you can send us a small sample, we shall be happy to pay the expense of same.

The Secretary reminded Members that Mr. Purcell's letter and Dr. Dey's report on this oil appeared in the monthly Proceedings for February 1879. He had lost no time, on receipt of the above letter, in addressing Mr. Purcell, but the letter was returned a short time ago, the addressee not being at Agra.

Agreed, that the letter be published in this day's Proceedings in the hope that it may attract Mr. Purcell's attention.

SUPPOSED VALUE OF THE JUICE OF EUPHORBIA AS A PROTECTION FOR IRON WORK.

The Secretary brought to the notice of Members a letter from Col. W. M. Lee, which was inserted in the Proceedings of December last, introducing a

cutting from the *Times* on the above subject. He (the Secretary) had addressed the Superintendent of the Botanic Garden of Cape Town on the subject, and had received the following letter from Mr. McGibbon on the subject:—

Since receipt of your letter of January last, I have been endeavouring to obtain more full information on the uses of Euphorbia Juice than I possess, but I am sorry to say, without success.

Euphorbia sap is not used in any form at the Cape, nor is it an article of export. I have consulted the Customs Returns to that effect. In the neighbouring colony of Natal a patent was taken out, some years ago, for the use of Euphorbia sap made into a form of paint for use on ship's bottoms, iron and wood, and marine structures generally. I have not learned that it is used in Natal for those purposes, nor do I find any of the sap is exported. I am told that the preparation of Euphorbia juice is worthless as a preventative against the attacks of *animal* life on wood or iron in water.

The species of succulent Euphorbia are very numerous at the Cape. The largest growing Cape sp. is *E. grandidens*. It reaches a height of 20 feet with numerous fleshy branches irregularly arranged round a straight stem. It is very abundant in the Eastern districts of this colony. It bleeds freely and copiously.

Another sp. found more to the Eastward and in Natal is *E. quinata* (a bad name of no authority I fear). This is the largest growing succulent Euphorbia I am acquainted with, exceeding in height *E. grandidens*, and larger in circumference than that sp. A good specimen of *E. quinata* (?) is a handsome object, although of so singular aspect. The quantity of juice yielded by this tree is very plentiful. From this and the preceding sp. the sap was taken, I believe, for experiment. I would have much pleasure in sending you a few young plants or a lot of cuttings of both, or of other Cape species of succulent Euphorbiaceæ, if you desire to have them.

Apologising for the delay in replying in reference to the above matters I venture to add a request for some seeds, as much as can be conveniently spared, of *Euchlæna luxurians*. This plant succeeds fairly in certain situations, but it does not seed freely (as yet) with us. It is desirable to distribute seeds of the plant to our farmers. [A large quantity has been sent.]

RHEEA FIBRE.

The next paper submitted was a letter from Mr. T. Sandys, dated 3rd August, to the Magistrate of Bhaugulpore, on the subject of Rheea Fibre, which is forwarded, together with a piece of the Rheea fibre tape therein alluded to by order of the Government of Bengal, in continuation of the papers inserted in the proceedings of last month.

APPLICATIONS FOR SEEDS AND PUBLICATIONS.

Letters were read—

From the Director, Department of Agriculture, N. W. P., requesting the

aid of the Society in procuring a quantity of the "Wheat Rice" from America, which is referred to in following extract from the *Pall Mall Gazette* :—

"A new sort of wheat, which is said to have been discovered in Arkansas about two years since, is at present attracting the attention of farmers in the United States. It is called wheat rice, and is supposed to have been originally brought to America by emigrants from the south of Russia. The grain is said to be well rounded and full, rather smaller than that of corn, yielding a fine white flour, which is more nutritious than either maize, oats, or rye, and forms an especially good food for every kind of cattle. The stalk of the plant is described as being tall, stiff, and plentiful. One of the peculiar qualities of the new cereal, and one which makes it particularly suitable to certain soils, is that it will live and thrive in districts where other kinds of corn would die on account of the dryness of the land. It remains unaffected by a drought of eight months. Its hardiness is likewise shown by the fact that it resists the attacks of almost every sort of insect, and the cost of cultivation is much less than that of wheat, maize, or rye. On analysis, the new corn has been found to contain 4 per cent. more starch and 3 per cent. more oily matter than wheat, but on the other hand, it possesses 2 per cent. less nutritive matter, and 5 per cent. less water."

From the Secretary, Local Fund, Kohat, to the same effect.

The Secretary intimates that steps had been taken towards meeting these applications.

From Secretary, Public Garden, Sumbulgre, applies for seeds of various kinds of the *Eucalypti*. Complied with.

From L. A. Bernays, Esq., V. P., Queensland Acclimatization Society acknowledging receipt of certain recent publications of the Society and asks for back numbers of Journal, Vols. 1 to 4, new series, to complete the set, "as your Proceedings and Journals contain so large an amount of most valuable matter."

It was agreed, on the recommendation of the Council, to present these back numbers to the Society in return for the many useful plants and seeds which Mr. Bernays has contributed towards this Society's Garden.

From Messrs. Thomson and Mylne of Beheea, forwarding some printed copies, giving detailed statements of the advantages derived from the use of their sugar-cane crushing mill, as proved by the figures of comparative costs given.

Thursday, the 23rd September, 1890.

W. H. Cogswell, Esq., V. P., in the Chair.

The proceedings of the last Meeting were read and confirmed.

The following were elected Members :—

Rai Jaikissen, Captain W. A. J. Wallace, Messrs. Charles Ryves and A. B. Holmes.

The names of the following were submitted for Membership :—

The Maharajah of Churkaree, Bundelcund,—proposed by the Secretary, seconded by Baboo P. C. Mittra.

The Manager of the Tarrapore Tea Company, Burtall Division,—proposed by the Secretary, seconded by Mr. J. E. MacLachlan.

James Strachan, Esq., C. E., Engineer and Secretary to the Kurrachee Municipality,—proposed by Mr. J. J. Cumming, seconded by the Secretary.

Rejoined.—D. W. Taylor, Esq., Grantee, Onde, R. M. Daly, Esq., H. M. Bengal Marine, and Poornanund Burrooh, Esq., Extra Assistant Commissioner, Deebroghur.

CONTRIBUTIONS.

1. Annual Report of the Royal Botanic Garden, Calcutta, 1879-80. From the Government of Bengal.

2. Report by Dr. Forbes Watson (Parts 1 & 2) on Cotton Gins and on cleaning and quality of Indian Cotton. From the Government of India.

3. Report on the working of the Cawnpore Farm for the Rubbee Season of 1879-80. From the Director Department of Agriculture, N.-W. P.

4. Report of the Queensland Acclimatization Society for 1879. From the Society.

5. A descriptive Atlas of the Cryptogams of Australia (sixth decade) from the Author, Baron von Mueller.

6. Memoirs of the Geological Survey of India, Vol. 16, Part 2. From the Director.

7. Journal of the Asiatic Society of Bengal, Part 1, No. 2, and Part 2, No. 2, and Proceedings for June. From the Society.

8. A small collection of plants (Orchids, &c.) from Borneo. Presented by Colonel W. M. Lees, on behalf of his brother, the Governor of Labuan. These have arrived in good condition.

9. Five kinds of Indian Corn raised from American seed. Presented by Charles Girdlestone, Esq., Resident in Nepal.

The following is a memorandum from Mr. Girdlestone respecting these specimens :—

The five different kinds of Indian Corn, of which single specimens are herewith sent, were grown in the private grounds of the Nepal Residency from seed directly imported from America in the spring of this year. The seed was sent by a Virginian planter. The smallest cob, with grains like seed pearls, is the pop corn. The other four kinds were only distinguished by the sender according to colour.

The corn has been grown in good loam, which had previously been ploughed three times by the Government plough made at the Cawnpore Farm, and fairly but not richly manured with stable and cow-house refuse. In a season which has been favourable for this crop it took about a fortnight longer to

mature than the ordinary Indian corn of this valley. The yield has been about one-fourth more than the ordinary kind grown in ground of a similar character and similarly prepared. Some of the stalks attained a height of 14 feet. The leaf is broader and the stem thicker than the indigenous kind, but I do not think that the plant covered more ground. The height of the Residency grounds is about 4,700 feet above the sea, and the average maximum temperature in the shade about 85 F.; the sun maximum in vacuo about 150 F., during the months that the crop has been growing.

The Secretary placed on the table specimens of four kinds of Indian corn from the supply received this season from the Society's seedsmen in Philadelphia. The Nepal raised corn contrasts favorably with them. The Secretary added that, to the best of his recollection, such fine specimens of Indian growth from imported seed had not been previously submitted to the Society.

Agreed, that these specimens be carefully preserved for trial in due season in the Society's Garden in order to ascertain, if any, and what deterioration occurs.

10. A small collection of plants and seed from the Nicobars. From E. H. Man, Esq.

11. Some plants (25) of the Ceara Rubber tree. From the Officiating Superintendent Royal Botanic Garden, Calcutta.

12. A quantity of acclimatized Aster seed. From C. Nickels, Esq., (Available to Members).

Mr. George Bartlett sent for the inspection of Members a fine grown plant of *Croton Kingii*. Mr. Bartlett, affords the following information regarding this plant:—

“During a casual visit to Barrackpore, three years ago, I observed a sickly plant of *C. pictum* growing under the shade of some trees, in fact the plants appeared to be on its last legs from starvation and want of light. On examining the plant I found one branch with the variegation of *C. Kingii*, although a very sickly one I secured it, and with much care and nursing, it has developed to its present state. The suffusion of a delicate salmon pink over the surface of the leaf, whilst the costa being of a bright pink gives the plant a pleasing and decided character. With the approval and permission of Dr. King I have named it after him.”

PLOUGH.

Submitted the following letter from Mr. W. J. Crawley, of Cawnpore, regarding the report from the Committee on the plough forwarded by him for competitive trial:—

I have to acknowledge receipt of the report of your Sub-Committee on the Cawnpore plough. I must respectfully demur from the decision arrived at.

Your Committee report that the plough cut a sod 5 in. wide and 4 or 5 in. deep; now this is the average work which an English plough does with a pair

of strong horses. It is unnecessary for me to tell you that the plough was never made to do such work as this with a pair of light Bengalee bullocks.

The plough failed to turn the sod over, this is its speciality, it was made so as not to turn the sod over but simply to raise and pulverize it (by means of its forked mouldboard) and drop it again, *without bringing any new soil to the surface*. I quote a paragraph from the *Pioneer* of 31st August, in support of the principle on which the plough is made. Mr. Mechi of Tiptree, one of the most practical Agriculturists of the present day, says, that though the wheat plant sends its roots several feet into the ground where the subsoil is sufficiently loose, "uses these roots more as a means of supplying itself with the moisture necessary for its existence, it is in the surface soil that the fibres seek for and obtain the principal elements of their food, in the presence of greatly increased heat and action. In the poor subsoil there is comparatively nothing for them but water, for Liebig has proved that the few inches of surface soil have the power to fix or retain all the ammonia, potash, and phosphate of lime applied to it, and these are the three main requisites of plant food." Mr. Mechi advocates deep ploughing or cultivation, while keeping the subsoil in its place. The subsoil should be thoroughly stirred with the "grubber" or "cultivator," which will disturb it without bringing it to the surface or mixing it with the fertile and friable top soil.

The plough being somewhat novel in shape, and in the absence of instructions as to its working, and the object for which it was made, your Committee considered, I presume, that to be thoroughly effective it should have turned the sod completely over.

BAMIEH COTTON.

Submitted a letter from the Under-Secretary, Government of India, Home, Revenue and Agricultural Department, forwarding a collection of papers and a note regarding the cultivation of Bamieh Cotton in India, and asking for a report on the result of experiments made with the additional quantity of seed received by the Society direct from Egypt in June 1878.

The Secretary placed on the table replies from several persons, to whom portions of the seed in question had been sent, including one from Mr. Westfield, with a photograph of one of his plants laden with bolls.

Agreed, that copies of these be forwarded to Government in reply to their enquiry.

COTTON SEED-OIL.

Read the following letter from Baboo Peary Chand Mittra, V. P., on the above subject:—

In looking recently over some old publications of the Society, I observed a short paper, written so long ago as 1837, by Mr. Charles Lyall, of the then firm of Lyall Matheson & Co., 'on the value of cotton seed for oil.' Mr. Lyall gives extract of a letter, dated October 1836, from a correspondent in New York, on

this subject, which is, I think worthy of reproduction, and have accordingly annexed it, as probably few, if any, of the present Members of the Society have a copy of the 'Transactions' (Vol. 4,) from which this extract is copied, to refer to.

I am not aware if much, if any, cotton seed oil is now exported from Egypt, nor what the export, if any, from Bengal, may be; but it does seem strange that when there is such an abundance of the material at hand, and when the demand for all kinds of oil is on the increase, that this particular kind should not be added to the many exports from Calcutta. Perhaps the insertion of this note in our monthly Proceedings may have the effect of drawing attention to, and eliciting some information on, this subject.

"Presuming it may interest the agricultural interests of Bengal, I deem it proper to mention that within a few days past, we have received orders at this Agency from His Highness the Pasha of Egypt, for all the necessary machinery, &c., for Steam Rice Mill, for husking and cleaning rice on an extensive scale, by the improved process employed in this city and in South Carolina and Georgia: also for a Cotton Seed Oil Mill to be worked by steam-power according to the patent process extensively used in this country, where the oil is now manufactured in large quantities and sells for about one dollar per gallon. It burns equal to the best spermaceti, and is successfully used as a substitute for almost every other kind of oil.

"One bushel of seed yields about 2 quarts of oil, the outer rind or pelicle of the seed supplies the only fuel used in working the steam engine; all the machinery and apparatus for an establishment capable of manufacturing about 300 gallons of oil per day, will cost about 15,000 dollars delivered on board in this port."

In connection with the above, the Secretary drew the attention of the Meeting to specimens of Upland Georgia cotton seed oil presented to the Society in 1838, by Dr. Hufnagle, an Honorary Member and Consul to the United States; also from Mr. C. B. Taylor of Palamow in 1845, and from Major T. Davis of Buldana in 1855. Though the subject had been frequently brought to notice by the Society at various times, yet, to the present day, not a single gallon of this useful oil had been exported from this side of India, whilst from the United States of America the export had considerably increased, as the following extract from a recent number of the *Times* would shew:—

"COTTON OIL.—The manufacture of cotton oil from the cotton seed is becoming of importance in the United States, there being at the present time upwards of 41 oil mills, of which nine are in Mississippi, nine in Louisiana, eight in Tennessee, six in Texas, four in Arkansas, two in Missouri, two in Alabama, and one in Georgia. The annual quantity of seed converted into oil now amounts to about 4,10,000 tons, the yield being at the rate of some 3 gallons of oil to the ton of cotton material. Moreover, each ton leaves 750lb

of oil cake of admirable fattening qualities. A great deal of the cotton oil is imported to Italy and other countries where the olive oil is a staple; and, in point of fact, cotton oil is there superseding the olive oil, not only for utilitarian purposes, but also as an article of food. It is said, too, that the use of cotton oil in this way is gaining ground in some parts of the States. The following are the statistics of consumption:—

Export.				Home Consumption.			
Gallons.				Gallons.			
1876-7	...	...	1,816,000	...	...	2,000,000	
1877-8	...	...	1,457,000	...	...	1,800,000	
1878-9	...	...	5,750,000	...	...	2,425,000	

Times of 13th August, 1880.”]

It would appear that cotton seed is also becoming one of the principal articles of export from Egypt. It has gradually risen from 1,000 cwts. in 1860 to about 3,500,000 cwts. in 1873 of the value of £7,77,000, and England takes nearly all this. During the last 20 years the imports of this seed into England have risen from twenty thousand tons to two hundred and thirty thousand tons. Cattle, as is well known, take readily to it and thrive upon it. In the United States it is used largely as a manure for Indian corn and indeed as a general fertilizer.

The Chairman remarked that the cattle connected with the Goosery Mills. throve well upon cotton seed. Dr. Lynch observed he had been informed that it was largely employed for this purpose in the Upper Provinces.

RHEEA FIBRE.

The Secretary next called attention to a letter from the Under-Secretary to the Government of India, to the Secretary to the Chamber of Commerce, forwarding samples of Rhea fibre in the bleached and half-bleached state, prepared in Lancashire, and requesting a report upon the quality and value of the fibre. These specimens Mr. Wood had handed to him (the Secretary) for his opinion, and he had submitted the following memorandum in reply:—

These samples are very beautiful and of excellent quality, but the commercial value cannot be given here, as it is almost an unknown article in this state of fineness. We have no machinery here to work it into cloth. The home market is the best test. There it would probably be valued as high as £200 per ton. Such was the value affixed on a sample similar to this in the possession of the Agricultural and Horticultural Society, which was also prepared in England from plants grown in a large glass-house.

As far as my experience extends, the parties in England interested in Rhea fibre prefer to obtain it from India in the raw state, as the cost of the after processes for preparation in the state of the samples now before me is comparatively small, and when so prepared the fibre sells for a large figure.

* I have also seen specimens somewhat similar to these prepared some years ago at Saharanpore from plants raised there; but it was I believe a tedious and expensive process as the experimenters were new to the work and had not the necessary appliances readily at hand.

Letters were read—

From the Director, Department of Agriculture, N.-W.P., forwarding a specimen of Gum, and requesting an opinion on its commercial value.

The Secretary stated that this Acacia Gum is in a very dirty state and not worth more than from 8 to 9 Rupees a maund in the local market. To contrast with it he had sent the Director a picked specimen of Gum from *Acacia Arabica* which is quoted as high as three shillings per pound in the English market.

From Col. H. R. Wintle, applying for a small quantity of good kind of Potato, and offering a quantity of acclimated flower seed for distribution among the Members of the Society.

The Secretary intimated that he had complied with Col. Wintle's request, and had accepted his offer of flower seeds.

From Col. Lucie Smith, Commissioner of Chattersghur, C. P., enquiring about Reana luxurians, and if the seed be procurable. (A large quantity of seed forwarded).

From Secretary Smithsonian Institution, Washington, returning thanks for certain publications of the Society. From Director Department of Agriculture, N.-W. P., to the same effect.

Thursday, the 25th November, 1880.

W. H. COGSWELL, ESQ., V. P., in the Chair.

The Proceedings of the last (September) meeting were read and confirmed.

The following were elected Members:—

The Maharajah of Churkaree, Bundelcund; the Manager of the Tarapore Tea Co., Burtall Division; and Mr. James Strachan, C.E., Kurrachee.

The names of the following were submitted for Membership:—

His Highness the Maharajah of Travancore,—proposed by the Rajah Suttayanund Ghosal, Bahadoor, seconded by Baboo Peary Chand Mittra.

M. G. Stewart, Esq., Merchant, Calcutta,—proposed by Mr. W. H. Cogswell, seconded by Mr. W. Stalkartt.

A. B. Kellie, Esq., Manager, Singtom Tea Garden, Darjeeling,—proposed by Mr. W. S. Creswell, seconded by the Secretary.

C. H. Pillans, Esq., Tea Planter, Phoolbarrie, Silligoorie,—proposed by Mr. G. L. Kemp, seconded by the Secretary.

Rejoined—Dr. R. H. Perkins, Jubbulpore.

The following Gentleman, was proposed, on the recommendation of the Council, as an Honorary Member:—

Captain J. F. Pown. Simla.

CONTRIBUTIONS.

1. Records of the Geological Survey of India, Vol. 13 Part 3, and Memoirs of Ditto, *Palæontologia Indica*, (Ser. 11, 1, 4) and Vol. 3 Ser. II, XI, and XII. From the Government of Bengal.
2. Madras Journal of Literature and Science for 1879. From the Editor.
3. Proceedings of the Asiatic Society of Bengal for July and August, 1880. From the Society.
4. Smithsonian Report for 1878. From the Association.
5. List of Articles from Bengal to the Melbourne Exhibition of 1880. From the Compiler.
6. A plant of *Croton Kingii*. From Mr. G. Bartlett.
7. Seed of *Doryanthes Palmeri*. From L. A. Bernays, Esq.
8. A small collection of Orchids from Sylhet. From C. K. Hudson, Esq.

GARDEN.

A report from the Garden Committee was read and agreed to. The Committee propose the erection on the west side, and contiguous to the Superintendent's house, of a substantial iron house, at a cost not exceeding one thousand rupees, for the proper display and safety of orchids, begonias, ferns, aroids, crotons of rarer kinds, &c.; and the removal of the *cutcha* shed to the south of the house, which is now appropriated principally for orchids, as it is an insecure position. "This recommendation"—the Committee observe "is quite independent of that made some time ago, for an ornamental structure in a more open part of the grounds, which they would still much wish to see carried out, if any wealthy native gentleman, would give the necessary amount; the house being called after his name, as is the case in the Zoological Garden houses." The Committee next recommend some further expenditure for the purchase of certain plants of which the stock is limited, and which are generally in request. They allude to the present establishment and to the cost thereof; and introduce a few details in respect to stock, &c. They close their report with the following remarks:—

"*Manures*.—A large quantity has already been collected during the past six weeks, and further supplies are being obtained without cost to the Society, except that of cartage. The Committee propose very shortly to call Mr. Kiernander's attention to the subject matter of their previous reports of March and April last in connection with the Resolution of the Government of India, (Agricultural Department) under date, the 27th February, 1880. The suggestions of the Committee were not carried out last rainy season, partly for want of the necessary material in shape of manures, partly to the attention of the Society having been called to the subject by the Government of Bengal, rather too late in the year, and partly to other causes."

In connection with the above the Secretary submitted the following notes on Garden operations:—

Tanks.—The tanks are full, especially that on the west side. They have not been so full since the formation of the garden. This is partly attributable

to the unusually heavy fall of rain this season, and partly to an improved system of drainage, whereby a larger quantity of water has passed into the tanks. The want of water in April and May of each previous year, is not likely to be felt during 1881.

Manure.—This is being largely collected from various sources, so as to ensure a good stock; so much needed for enriching the orchard, flower garden and other parts.

Propagation.—Layering and other modes of propagation on fruit trees and ornamental plants have been steadily carried on during the past rainy season, so as to ensure a good stock for distribution.

Distribution of Plants.—This has been greater than usual to all parts of the country, about 230 delivery orders have been issued to date, besides many (70) supplementary orders. The collection of certain kinds, notably Palms and Crotons is still great, and it would be desirable if members indented more freely for these; also for such useful plants as Mahogany, Pithecolobium Saman, Beana, Sago Palm, Coffee, both Liberian and Arabian.

Contributions.—Several contributions in the shape of plants and seeds have been received since the submission of last report, most of which have been notified in the Proceedings.

The Garden is, altogether, in a clean condition and the produce fairly well arranged. Roads have been well kept, and the grass closely cropped.

Germination of seeds.—The result of trials is as follows:—

Vegetable.—From Sutton and Sons of Reading, a gross general average of 40 per cent., 9 kinds have failed, namely, Asparagus, Canadian Bean, Celery, Lettuce, Marjoram, Onion, Parsley, Sage and Thyme. A subsequent sowing of these was made, and six kinds have germinated. Asparagus, Beans, Onion, Sage, and Thyme have failed.

From Buist of Philadelphia, 30 per cent. 2 kinds have failed, (Onion and Parsley.)

Flower.—From Sutton and Sons and Haage and Schmidt and from Lucknow. Reports on these will be submitted hereafter.

A good piece of the ground which was partially prepared some months ago for manure operations on certain crops has been set apart for raising peas, for distribution of the produce next season.

ALOE FIBRE.

Submitted the following letter from Mr. C. S. Faddy, District Engineer, Hushnarpur, Punjab, and report on the fibre therein referred to:—

"I am sending you by to-day's post a small parcel containing. (I) Sample of Fibre.

(II)

(III) a small length

of rope. And shall feel obliged by your kindly favoring me with an opinion as to whether the fibre could obtain any value as an article of commerce in the

Indian or Home Markets. The plant from which this fibre is produced grows freely all over Northern India, but no use is ever made of it by the Natives. I also send a small quantity of combings suitable perhaps for tow or paper fabric."

Mr. W. H. Cogswell, a Member of the Fibre Committee, gives the following report on the above samples, Mr. S. H. Robinson, concurring:—

"With reference to the samples herewith alluded to in the foregoing memorandum, I beg to observe that the washed and heckled fibre prepared from the "Agave Americana" or common aloe, is about the best I have seen, being beautifully clean and well freed from the bark or outer skin of the plant, of good color, there being but a very slight tinge of greenish, which it is impossible to thoroughly eradicate without extra steeping, or the addition of chemicals, to the injury of the fibre; it is of very great length and fair strength and a really good commercial commodity, its value to day being about eight rupees a bazar maund."

"The sample unchecked I would value at about one rupee a maund less."

"The sample of combings, generally known as tow, could be used in this country for paper-making only, its value as such being about three rupees a maund, but in England, where spinning machinery can be applied to it, a good yarn might be produced. As a product for shipment thereto it is of greater value than being consumed locally for paper-making. For the latter, I am of opinion, it is too good and costly, as jute tow, and such like fibres, are so cheap and plentiful in this market."

ON THE INTRODUCTION OF CERTAIN FOOD GRAINS IN THE HIMALAYA.

The following extracts of a letter from Captain J. F. Pogson, dated Koteghur, 12th November, were next submitted:—

It may interest the Agri-Horticultural Society to know, that the Moravian Missionaries at Keelung, in Lahoul, are very successfully cultivating Rye, (*Secale Cereale*) in that most out of the way portion of British territory. The Rev. Mr. Hyde, was here in October, and stated that some seed Rye, was sent him in a letter from Germany, which was sown, grown, and harvested, and by several annual sowings of the produce, this new and valuable cereal has been fully established in Lahoul, so, to these Missionaries belongs the credit of doing a most useful thing, whilst we have not got beyond the writing stage. Perhaps Himalayan Tea planters will now be induced to import seed Rye, and cultivate this cereal, next year. Mr. Hyde mentioned the Quinoa seed [*Chenopodium quinoa*] sent him by the late Sir Donald Macleod and said, that the crop was harvested at maturity. The people did not fancy it as a food grain, nor do they care much for Rye. The Quinoa he held would grow best in a tropical portion of the Himalayas, Lahoul being beyond the tropics and having a spring and summer very much resembling that of Canada.

You may remember that I suggested this food grain should be tried in the high ranges of Hills north of Simla, at, and above elevations of eight to ten

thousand feet of altitude above the sea level. Thus Mount Huttoo and the Upper parts of Narkunda would have produced good crops of Quinoa. Practically speaking the experiment was so managed as to ensure failure.

I have promised Mr. Hyde, seeds of Maize, and "Maha kuddoo," and shall be much obliged if you will in due season, let me have at least, 100 picked seed of the pumpkin in question. Mr. Manikin, Forest Officer and Assistant Superintendent Hill States, wishes to introduce it into Kilba, and Nachar, in Kunawar, and Rev. Pagel, wants it for his Mission Station in Pu, in a Thibetian Pergunnah, belonging to the State of Busahir.

On the banks of the Sutledge at Kapoo the "*Sumbudai* Zemindar, was supplied by me with acclimatized American Maize seed and "Maha kuddoo." The man was so pleased with his abundant maize crop, that he has preserved all the cobs, for next year's sowing, and other Zemindars have done the same. Now as Cuzco maize of kinds, red included, has been successfully grown at Kapoo, I have reason to believe that the very large seeded Cuzco maize grown by Colonel Chamberlain, at Ranekhet, and myself at Simla, will answer at Kapoo; therefore if you can secure me some of this seed I will get the Zemindar to cultivate it. The kuddoo, also flourished, and as it would have required four Paharees, to bring the largest one up hill to Kotgurbh my leave was asked, as to incurring the charge, and as paying a rupee to look at a pumpkin was not necessary, I was satisfied with the description, "length 3 feet, width $1\frac{1}{2}$ cubits (27 inches) weight a load for 4 men, which may be called 120 seers, or 3 maunds. From Nirit 9 miles en route from this to Rampore, another monster pumpkin was reported. So the valley of the Sutledge agrees with the pumpkin.

I hope those who have tried thin cultivation in the plains have been as, if not more, successful.

When it comes to hand I should like to obtain one or two oz. of the so called Wheat rice, or more if it can be spared, as I will send some to Lahoul, (Keelung) and Pu.

In reference to the Quinoa as mentioned by Captain Pogson, the Secretary called attention to the following particulars from the *Treasury of Botany* :—

"The species to which the greatest interest attaches is, however, C. Quinoa, indigenous to the Pacific slopes of the Andes, where it is largely cultivated in Peru and Chili for the sake of its seeds, which are extensively used as an article of food. They are prepared either by boiling in water like rice or oatmeal, a kind of gruel being the result, which is seasoned with the Chili pepper and other condiments; or the grains are slightly roasted like Coffee, boiled in water and strained, the brown coloured broth thus prepared being seasoned as in the first process. This second preparation is called 'Carapulque,' and is said to be a favourite dish with the ladies of Lima.

However prepared, the Quinoa is unpalatable to strangers, though it is probably a nutritious article of food from the amount of albumen it contains.

Two varieties are cultivated, one producing very pale seeds called the white, which is that employed as food, and a dark red fruited one called the Red-quinoa. A sweetened decoction of the seeds of the latter is used medicinally, as an application to sores and bruises, and cataplasms are also made from it."

Agreed—That the major portion of the fine maize from Nepal, recently presented by Mr. Girdlestone, be forwarded to Captain Pogson for trial.

CROCODILE OIL.

The Secretary drew attention to the following extracts of letters from Messrs. J. Purcell, of Allahabad, and J. M. Keane, of Agra, in reference to the letter from the Eglinton Chemical Company of Glasgow, which was read at the August Meeting:—

Mr. Purcell. "I am in receipt of your favors dated 18th July and 17th instant, and am sorry I have no oil (Crocodile) with me that I could send you for the firm in Scotland.

"In December last I had a very large quantity of Crocodile oil at Agra. I sent a bottle full as samples to several firms when I sent you some, but have received no favorable reply, and as also that of Dr. K. L. Dey being unfavorable, I gave the oil away to the native leather curers and servants, the latter used it for months for lighting purposes, and it showed a fine clear bright light. While at Mussoorie in October or November last, I also received a pamphlet from some chemical firm either from England or Scotland I am not certain, but being about to leave for the plains I mislaid it or lost it."

"At present the river is high but about December next I might be able to send you some oil say a 5 gallon Kerosine oil can. Had Dr. Dey's report been favorable I could have sent you as much oil as the firm would have required.

Mr. Keane. "I am in receipt of your favor of the 7th instant. The Crocodile oil can only be procured in small quantities from the Sais in the Punjab. If the Glasgow firm who wish to obtain it would pay my passage to Lahore and back I would be happy to take a trip there and obtain as much as I could for them, but it would, I think, be better for them to start a Factory for it somewhere here or the Punjab as they could then depend upon its purity, and in conjunction with it the skins might be roughly tanned and exported to Glasgow as it makes excellent fishermen's boots, but of course it would need capital. I would be happy to undertake its management if they are inclined to speculate in it."

Resolved—That a copy of this day's Proceedings be sent to the Glasgow Company for their information and for such steps as they may desire to take.

RAVAGES OF THE WHITE ANT ON TEA ESTATES.

Read a letter from Messrs. Octavius Steel and Co., intimating that the White Ants are causing some of the Managers of their Tea Estates much annoyance and even anxiety, that they have not succeeded as yet in finding any

effectual means of killing them off though they have with much perseverance tried lime, kerosine oil, charcoal and other supposed remedies without any permanent effect; and requesting to be informed of any other suggested treatment likely to check if not stop entirely their ravages.

The following is copy of reply to the above application :—

“ The subject of the destruction caused by White Ants on living plants, and inanimate, objects, has been frequently before the Society at various times, and certain remedies for their removal have been suggested, but apparently with little or no effect. I may, however, mention that many years ago these insects caused much depredation on plots of sugar cane of foreign kinds in the Society's garden. Various supposed remedies were ineffectually tried, but only one had any real effect, and that was mustard cake. This was applied in the first instance, simply as a manure for the cane; but it had quite unexpectedly the effect of introducing the red ant largely into the plantation, and these completely destroyed their white brethren; so much so indeed that we were not troubled again by the latter.

“ I would recommend this being attempted in your tea gardens; besides a constant hoeing round about the roots of the plants, which may also assist towards the extirpation of this formidable pest.

COMMUNICATIONS ON VARIOUS SUBJECTS.

1. From L. A. Bernays, Esq., V. P. Acclimatisation Society of Queensland, returning thanks for seeds of sorts, and for back numbers of the Society's Journal.

2. From the Director Imperial Botanic Garden St. Petersburg, tendering acknowledgments for certain publications of the Society.

3. From Col. Lucie Smith, Commissioner, Chutesghur, C. P., returning thanks for the large supply of seed of *Reana luxurians* supplied, and promising to communicate the result in due course.

4. From Rai Chowdry Kooshur Prosad Bahadoor of Nanpore, intimating the success which has attended his sowings of the seeds of *Reana* received from the Society.

5. From T. S. Anderson, Esq., regrets he will not be able to fulfil his promise of obtaining another supply this year of potatoes for the Society from Melbourne, as his correspondents have not been able to arrange for a ship to come up as usual to reach this by the end of November.

6. From Baboo P. C. Mittra intimating, with reference to his communication at the last General Meeting, that he has addressed the Government of the N. W. Provinces on the subject of Cotton-seed-oil.

7. From the Commissioner Chota-Nagpore, submitting particulars from the Jailor at Hazareebaugh regarding the cultivation of the Carob-tree (*Ceratonia siliqua*.) (Transferred for Journal.)

Thursday, the 16th December, 1880.

W. H. COGSWELL, Esq., *V. P.*, in the Chair.

The proceedings of the last meeting were read and confirmed.

The following were elected Ordinary Members:—

His Highness the Maharajah of Travancore, Messrs. M. G. Stewart, A. B. Kellie, and C. H. Pillans.

Honorary Member.—Captain J. F. Pogson,

CONTRIBUTIONS.

1. Report on the progress and condition of the Royal Gardens at Kew for 1879. From the Director.

2. Memoirs of the Geological Survey of India, Palæontologia Indica, Ser. XI. Parts 1, 2. From the Director.

3. Transactions of the Asiatic Society of Japan, Vol. 8, Part 3. From the Society.

4. Journal of the Asiatic Society of Bengal, Part 1, No. 3, 1880. From the Society.

It was agreed, on the recommendation of the Council, that orders for vegetable seeds from England and America, similar to those for 1880, be given for next year. Further, that as the flower seeds have not been favourably reported on by several Members, nor by the Garden Superintendent, that the orders be distributed to several seedsmen in England and the Continent. The season in England for 1879, was very unfavorable for the gathering of flower seeds.

It was further agreed that an exhibition of vegetables and fruits be held in the Town Hall on Thursday, the 20th of January and of flowers in the Garden on Thursday, the 3rd of February.

The Secretary reported that a large consignment of Rose plants from Mr. W. Bull, had been recently received in excellent condition, only one out of 200 plants having been found dead on opening the box.

Letters were read from the Government of the Punjab applying for a large quantity of seed of *Reana luxurians* for sowing along the banks of canals in the Baree Doab and Western Jumna Circles and for cotton seed of the Bamleh variety.

The Secretary reported that he had been able to comply partially with the request for Reana seed, but that no cotton seed was available.

From Messrs. Peel Jacob and Co., applying on behalf of correspondents in Cochin China, for full information in respect to the culture and manufacture of Jute.

The Secretary intimated that he had been able to meet this request through the kindness of the Chairman. Agreed, that the valuable information now given be printed in the next number of the Journal for general information.

REPORT
OF THE
Agricultural and Horticultural Society
OF
INDIA
FOR 1880.

*Report from the Council at the Annual General Meeting, held on
the 13th January, 1881.*

At the commencement of another year, it devolves upon the Council to submit to the Members a few remarks in connection with the operations of 1880.

And, first, in respect to the internal economy of the Society. The number of Members elected and rejoined (57) is less than in 1879; but the resignations (32) are also less. The number removed for non-payment of subscriptions (33) is likewise less than last year; for deaths (8*) which are not so numerous as in 1879, and 12 for long absence from the country. These reduce the numbers to 615, classified as follows:—*viz.*, 29 Life-Members; Honorary, Associate, and Corresponding 20, and nominal-paying Members 566. Of this number 58 are absent from India, and 37 have failed to contribute in 1880; thus reducing the actual effective number of paying Members to 471, or 14 less than last year.

The following list shews the distribution of Members. Of

* Messrs. John Scott, R. Groundwater, W. H. Jones, and L. Mandelli;
Dr. J. H. Barry, Baboos Rajkissen Mookerjee, Hitloll Missir, and Maharajah
Jaising Deo Bahadoor of Chikkarree.

the whole, 137 are resident in Calcutta, 395 in other parts of the country, and 83 in Europe:—

CLASSIFICATION.	In 50 previous years.											Gross Total.	Total real number at the close of 1880 after deducting lapses.
		In 1871.	In 1872.	In 1873.	In 1874.	In 1875.	In 1876.	In 1877.	In 1878.	In 1879.	In 1880.		
Honorary Members ...	20	2	0	0	0	1	1	0	0	2	2	28	12
Associate " ...	6	0	0	0	0	0	0	0	0	0	0	6	2
Corresponding,, ...	14	0	0	0	1	0	0	0	0	0	0	15	7
Civilians, Covenanted and Uncovenanted ...	693	24	14	10	14	16	14	5	6	5	3	804	59
Merchants and Traders ...	606	14	10	10	18	15	9	2	4	7	6	701	78
Agriculturists ...	596	22	27	19	41	90	30	31	17	20	13	906	215
Military Officers ...	639	34	12	15	4	4	6	4	4	6	4	732	58
Medical " ...	229	8	8	7	6	7	5	2	4	2	3	281	29
Asiatics ...	267	16	8	8	25	10	15	19	8	14	12	402	92
Clergy ...	39	0	1	1	0	0	0	0	0	1	0	42	4
Law Officers ...	121	4	4	2	6	6	1	0	4	2	1	151	21
Miscellaneous, Police, Civil Engineers, &c. ...	137	9	3	17	8	12	10	17	18	16	13	260	38
TOTAL ...	3,367	133	87	89	123	161	91	30	65	75	57	4,328	615

It will be observed that among those who have been removed by death is Mr. John Scott, Curator of the Royal Botanic Garden, Calcutta. Mr. Scott was the contributor of several valuable papers to the Journal, among them "Notes on Horticulture in Bengal" and "a list of the higher Cryptogams cultivated in the Royal Botanic Garden, Calcutta," and several other minor papers. Mr. Scott was always ready to assist the Society on all subjects referred for his consideration. With an observant and original mind, in him was united great modesty and unobtrusiveness of character. He was elected an Honorary Member in 1871. His death in the prime of life is not only a great loss to the Society, but also to Vegetable Physiology, of which he was an ardent and able votary.

The Council have also to allude to the loss sustained by his departure from India during the year of Sir Louis Jackson, C.I.E., late President of the Society. In the proceedings of the General Meeting in May, in which Sir Louis' letter of resignation was submitted, will be found the resolution of the Society expressive of their "warm appreciation of the interest he has taken, and the valuable services he has rendered, in dealing with the various subject that have been under consideration during his

four years' tenure of office." Sir Louis Jackson was, at the same time, unanimously elected an Honorary Member.

The financial position is much the same as it was last year. Though there has been a decrease of expenditure in some heads, there has been an increase in others, which nearly equalizes the account. The cash balance in the Bank of Bengal is Rs. 3,200, and arrears of subscription, &c., are Rs. 1,788, making a total of Rs. 4,988. Against this sum there are liabilities to the extent of Rs. 3,461, leaving a balance in favor of the Society of Rs. 1,527.

Of the balance of arrears of 1875-79, namely, Rs. 2,596, the sum of Rs. 1,050 has been removed from the books as irrecoverable, and Rs. 1,316 have been realized during 1880. The arrears of 1880 amount to Rs. 1,558.

The annual shows of vegetables, fruits and flowers were held as usual in the early part of the year,—that for the former in the Town Hall on 29th January, and the latter (flowers) in the garden on the 16th February. The vegetable show was an excellent one, perhaps, the largest, or one of the largest, held during the last forty years. The flower show was also about equal to those of former years, and the attendance was large. It was found necessary, in the interest of the market gardeners, to hold the show of vegetables and fruits separately instead of, at one time, as heretofore, and in the forenoon, instead of the afternoon, to allow of their selling the produce immediately after the closing of the exhibition.

Vegetable and flower seeds were imported as usual, and widely distributed. There have been many complaints in respect to the flower seeds which may be mainly attributable to the adverse season in England of 1879 for ripening seeds. It is proposed in future to order a more select assortment of flower seeds, consisting of those that are known to succeed well in Bengal and Upper India, and to increase the quantity of such. It is hoped this will afford satisfaction to the majority of Members.

In respect to the Garden, it may be noted, that the distribution of plants is gradually increasing, as their privilege of indenting on it annually is becoming better known to Members. Applications (250) for delivery orders have been duly met; besides many (80) supplementary orders. Of ornamental plants, 9,350 have been distributed to Members, besides a quantity of economic plants and cuttings. In addition thereto, there have been sales to Members and the outside public of 1,440 fruit grafts, and 1,212 ornamental plants. To increase the stock of roses, for which the demand continues greater than for any other class of plants, supplies have been received, by exchange, from the public gardens of Allahabad, Agra and Lahore. A consignment from Mr. Bull of Chelsea, arrived in the early part of the year unfortunately in a totally unserviceable condition, scarcely one alive. A subsequent consignment in November reached

in excellent condition. The demand for economic plants, Mahogany, Coffee (Arabian and Liberian) *Pithecolobium saman*, and certain timber trees, has been constant. The supply of some of these is still great, while of ornamental plants the stock is also large, notably of Crotons, Palms, Dracenas, and a few other kinds of variegated foliage. The collection of fruit grafts, especially of Mangoes of many kinds and of Lychees, is now sufficient to meet a fair demand.

The contributions to the Garden have been as great as last year. The Society is especially indebted to the Queensland Acclimatisation Society, Mauritius Botanic Garden, Calcutta Botanic Garden, the Baron F. Von Müller, Messrs. C. Ady and Rowett of Rangoon, C. K. Hudson, C. Nickels, E. H. Man, Dr. R. Beaumont, Col. W. M. Lees, and Capt. J. F. Pogson.

The attention of the Society was called by the Government of Bengal, in the early part of the year, to the desirability of trials with certain kinds of manures on certain crops in connection with some recent experiments at the Bangalore Farm. The Garden Committee took initiatory steps towards meeting the wishes of Government, but being unable to undertake the trials in the manner suggested, have deferred doing so for another season, when they hope to carry them out as fully as the means at their command will admit.

Trials were also made at the commencement of the rainy season with several newly manufactured ploughs submitted for competition. The report of the Committee will be found in the proceedings for July.

There has been a fair demand throughout the year for seeds of useful kinds, other than vegetable and flower, and many applications for information on various subjects; all which have been complied with. Notices of some of these are recorded in the monthly proceedings. In addition to these, certain papers of interest have been submitted regarding cotton and cotton seed oil, tobacco, fibres of sorts, &c., which have been discussed and reported on.

The Council cannot close this brief summary without reiterating, what has been more than once urged in previous annual reports, that unless they have a more hearty co-operation from Members generally, resident and non-resident, they cannot expect the operations of the Society to be conducted with that success which characterized its proceedings in former years. It was by the united efforts of public-spirited men that the Society was founded, it is mainly by a continuance of such efforts that its influence and prosperity can be maintained. It is true that times have changed, that European Society in India is becoming annually more fluctuating (many considering themselves merely birds of passage.) It is, moreover, the fact that competition in all branches of life—public and private—has become greater;

that Europeans have not the same amount of leisure that was possessed by their predecessors to render such assistance as could be desired to public Institutions. Still notwithstanding these and other drawbacks that may be existing, if those who are interested in the Society's work, (and it is but reasonable to suppose that some are) would annually induce one or two friends to join it, the number of subscribers would soon be considerably increased. With such increased numbers would come increased influence and increased power for useful work, of which it may be added, there is much before us, if we possessed the necessary means of application.

The Council regret also to observe that while the spread of education is rapidly increasing in this country, the landed proprietors and other intelligent natives, Hindu and Mahomedan, have not as yet, with few exceptions, shewn that interest in the proceedings of the Society which might naturally be expected from a class who would derive most benefit. Such was not the case in former days when the leading members of the native community, not only took an active part in our proceedings, but contributed to its Transactions. They do not now number even one-sixth of the entire list.

Since the issue of the last Report only one number of the Journal has been published, Vol. VI, Part 2. Another is now in the press, and will be distributed in the early part of 1881. The Council would also request more assistance in this department. We have, indeed, competition here again, where formerly we had the field almost entirely to ourselves. Nevertheless more might be done than has been recently effected. We would ask not only Members, but the public in general, (Zemindars and other Agriculturists) who are favorably situated, to co-operate in this line. Let each contribute his item, however apparently unimportant it may appear to be, of sound practical information, founded on facts, the result of his own experience, and we shall be enabled to publish annually a much larger number of useful papers, and be in a position to disseminate them more frequently for general information, and thus confirm the words of the Founder of the Society, in his opening address, some 60 years ago—that “a body of men engaged in the same pursuit form a joint stock of their information, and thereby put every individual in possession of the sum total acquired by them all.”

*Statement of Receipts and Disbursements of the AGRICULTURAL AND
HORTICULTURAL SOCIETY OF INDIA, from 1st January to 31st
December, 1880.*

RECEIPTS.

From Members, subscriptions collected during the year	...	...	...	16,946	9	4
„ Proceeds of country vegetable, acclimated flower and other seeds	...	735	8	0		
„ Proceeds of surplus stock of American and English vegetable, English and German flower seeds, and Melbourne field seeds, &c.	...	3,283	1	3		
				4,018	9	3
„ Government—Proceeds of surplus stock of American vegetable and of English vegetable and flower seeds specially imported for H. M.'s Soldiers' Gardens	...	1,240	0	0		
				5,258	9	3
„ Proceeds of copies of Journals of the Society	...	30	8	0		
„ Proceeds of copies of other publications of the Society	...	33	12	0		
				64	4	0
„ Proceeds of admission tickets for non-Members to the Flower Show held in February	...	182	0	0		
President's donation	...	50	0	0		
				232	0	0
„ Amount of freight repaid	...			719	11	9
„ Amount of suspense account in deposit for appropriation on various accounts	...			74	8	0
„ Amount of packing and forwarding charges on seeds, plants, &c.	...			2,311	8	6
„ Garden—Proceeds of fruit grafts	...	929	7	0		
„ Proceeds of ornamental plants	...	2,872	5	0		
				3,801	12	0
„ Proceeds of boxes, pots, and Wardian cases	...	395	6	6		
„ Amount of cooly hire for packing plants, &c. &c.	...	174	14	0		
				4,372	0	6
Total, ordinary receipts, Rs.	...			29,979	3	4

EXTRAORDINARY RECEIPTS.

From Government of Bengal—Donation from December, 1879 to November, 1880	...	2,400	0	0
Moharaneesurnomoyee of Cossimbazar—donation	...	100	0	0
				2,500 0 0

Brought forward ...	...	2,500	0	0	29,979	3
From rent of large room of the Hall from December 1879 to November, 1880 ...	1,200	0	0				
Rent of stable and coach-house from September to November	52	10	9				
Rent of ground to west of compound from May to November, Society's proportion	194	14	6				
				1,447	9	3	
					3,947	9	3
	Total Receipt, Rs.	...			33,926	12	7
Balance in the Bank of Bengal on 31st December, 1879	3,429	6	4
	GRAND TOTAL, Rs.				37,356	2	11

DISBURSEMENTS.

SEED ACCOUNT.

By Mr. W. Bull, for cost of bulbs received in 1879	178	13	5
„ Mr. Robert Buist, Jr. for balance of consignments of seeds received in 1879 and in part for 1880 ...	5,058	2	5
„ Messrs. Sutton & Sons for ditto ditto for account of the Society ...	5,136	7	5
And in full for ditto ditto imported for Government	903	14	8
	<hr/>	6,040	6 1
By Messrs. Haage and Schmidt in full for consignment of flower seeds received from Germany in 1880 ...	536	5	7
„ Mr. W. Adamson in full for consignment of field seeds from Australia received in 1880	219	10	0
„ Horticultural Garden, Oudh, in full for acclimatized flower seeds ...	402	9	0
„ Sundry parties for country vegetable seeds, &c.	277	5	9
„ Freight and charges paid on seeds imported for Government ...	43	12	0
	<hr/>	12,757	0 3

LIBRARY ACCOUNT.

„ Messrs. H. S. King & Co. for sundry publica- tions	...	...	102	8	0
„ Books purchased	...	...	4	10	0
„ Duftry for binding books	...	...	28	8	0
					135 10 0

PRINTING ACCOUNT.

„ Printing money receipts, annual reports, letters of call, &c. &c. ...	42	2	6
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FURNITURE ACCOUNT.

„ Repairing chairs	5	8	0
				<hr/>		
				12	940	4 9

Brought forward	12,940	4
ESTABLISHMENT ACCOUNT.				
By Office Establishment, from December, 1879 to November, 1880	...	...	8,773	4
ADVERTISEMENT ACCOUNT.				
„ Advertising notices of meetings, seeds for distribution, surplus seeds for sale, &c. &c.	...	...	119	6
FREIGHT ACCOUNT.				
„ Freight paid on packages of seeds plants, &c. sent to Members	...	...	868	5
METCALFE HALL ACCOUNT.				
„ Proportion of house rates from October, 1879, to September, 1880, and police, lighting and water rates from January to December, 1880	...	585	0	0
„ Matting and sundry petty works to the Building	...	29	10	0
			614	10
STATIONERY ACCOUNT.				
„ Stationery purchased	...	...	40	10
REFUND ACCOUNT.				
„ Amount refunded, balance of Account due to Members	...	...	24	0
JOURNAL ACCOUNT.				
„ Messrs. T. Black & Co., for printing 600 copies of Journal vol. vi. part ii.	...	403	8	0
„ Sundry extra papers for the Journal	...	7	8	0
			501	0 0
VEGETABLE AND FLOWER SHOW ACCOUNT.				
„ Prizes distributed to Mallies for exhibiting flowers	...	309	0	0
Ditto ditto Vegetables and fruits	...	281	0	0
			590	0 0
„ Advertising, printing, carriage hire, fee for band, hire of tents and sundry expenses incurred	...	263	9	3
			853	9 3
PETTY CHARGES ACCOUNT.				
By Postage on letters, circulars, Journals, &c. &c.	...	155	0	6
„ Punkawallahs, carriage, boat and cooly hire, extra packermen, landing and forwarding charges, cost of wax cloth, oil cloth, twine, tin boxes for acclimated flower seeds, &c. &c.	...	372	6	0
			527	6 6
Rs. ...				25,262 8 6

Brought forward ... 25,262 8 6

GARDEN ACCOUNT.

By Cost of sundry materials for propagation of roses, fruit grafts, orchids, &c. ...	172	1	3		
„ Cost of tools, implements and contingencies ...	638	8	9		
„ Assessment on garden house and service tax ...	187	4	0		
„ Cost of boxes and pots purchased ...	488	3	0		
				1,486	1 0
„ Salary of Head Gardener, from December, 1879 to November, 1880 ...	2,300	0	0		
„ Wages of Native Establishment, mallies, coolies, &c. for ditto ditto ...	3,492	1	0		
„ Cost for repairing out offices and mallies ...	258	4	0		
				Rs. ...	7,536 6 0

PLANT ACCOUNT.

„ Mr. W. Bull, for consignment of plants received from him...	128	4	10		
„ Sundry parties for fruit seedlings, Liberian coffee seedlings, Orchids, Araucarias, &c. &c. including charges for freight, &c., on plants from different places...	1,228	1	0	1,356	5 10
					8,892 11 10
Total Expenditure, Rs. ...	34,155	4	4		
„ Balance in the Bank of Bengal on 31st December, 1880 ...	3,200	14	7		
GRAND TOTAL, Rs. ..	37,356	2	11		

MEMORANDUM.

DISBURSEMENTS.		Rs. As. P.
To amount of Ordinary Disbursements during the year 1880, as per Statement ..	25,262	8 6
" Amount of Garden expenditure during the year 1880, as per Statement ..	7,536	6 0
" Amount of cost of plants purchased ..	1,336	5 10
	8,892	11 10
Balance in the Bank of Bengal on 31st December, 1880 ..	34,155	4 4
	..	3,200 1 7
GRAND TOTAL, Rupees ..		37,356 2 11
RECEIPTS.		Rs. As. P.
By Balance in the Bank of Bengal on 31st December, 1879 ..	3,429	6 4
" Amount of Ordinary Receipts during the year 1880, as per Statement ..	29,979	3 4
" Amount of Extraordinary Receipts during the year as per ditto ..	3,947	9 3
	33,926	12 7
GRAND TOTAL, Rupees ..	37,356	2 11
ASSETS.		
Amount of Cash Balance ..	..	3,200 14 7
Balance of Subscription, &c., due from Members from 1876 to 1879 ..	229	12 3
Ditto ditto in 1880, as follows:—		
Balance of Subscription Rs 812 11 6		
Balance of plants, seeds, ..	746	1 9
freight, &c. &c. ..	1,558	13 3
	1,783	9 6
TOTAL, Rupees ..	4,989	8 1
Memo:		
Society's proportion cost of erecting the Metcalfe Hall ..		23,657 15 9
In landed property including Building at Alipore ..		20,646 6 0
Grant Testimonial Fund invested in Government Securities ..		3,880 14 11
		48,985 4 3
LIABILITIES.		
Messrs. Sutcliffe & Sons, for balance of seeds supplied in 1880 ..	£ 163	10 2
Mr. Robert Buist, Jr. for ditto ..	119	19 4
	£ 283	9 6
Exchange @ 1s. 8d. for the Rupee—Rs. ..	3,461	11 0

